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ABSTRACT

Intended for use by persons in developing countries responsible for initiating or expanding the use of audiovisual facilities and techniques in industry, this manual is designed for those who have limited background in audiovisuals but need detailed information about how certain techniques may be employed in an economical, efficient way. Part one, which focuses on the use of audiovisuals, includes a brief introduction and discussions of factors involved in the selection process and in the actual use of such materials, including cost effectiveness and facilities. Under the heading Techniques and Tools, the second part presents some basic considerations in preparing artwork for projected materials; brief descriptions of such non-projected aids as storyboards, flipboards, and flannelboards, together with their advantages and disadvantages, construction, and advice on use; general instructions for voice production; equipment for projected still pictures and guidelines for producing effective presentations; information on motion picture projectors and production techniques; and an overview of the types of videotape recorders available with suggestions for using VTR equipment and closed-circuit television. Procedural diagrams, pictures, and figures supplement the written text, and an international directory of institutions and organizations concerned with film making or educational media is attached. (MER)

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Development and Transfer of Technology Series No. 6

AUDIO-VISUAL TECHNIQUES FOR INDUSTRY

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UNITED NATIONS
New York, 1978

Preface

Audio-visuals are tools used to improve the transfer of information. They can be simple or sophisticated, ranging from the chalkboard and sound-slide to industrial films and electronic video recording.

Industry in the developed countries uses audio-visuals in many ways. They are used as aids in the presentation of technological information about new equipment, products and processes; in training programmes, ranging from simple technical training to training for top executives; in product or project evaluation; in research and development; in promotion of products and projects; in explaining new administrative procedures emanating from headquarters; in lectures, seminars and workshops; in staff development programmes; and in briefing of new personnel.

However, the use of audio-visuals by industry in the developing countries has lagged behind. This manual is intended to help remedy this situation. It has been designed for persons in developing countries responsible for initiating or expanding the use of audio-visual facilities and techniques in industry in the hope that it will help them to improve their presentations through the use of some basic techniques. Finally, the manual is designed for the person in developing countries who has little or no background in audio-visuals but needs detailed information about how he can use these techniques in an economical, efficient way, taking into consideration his own local conditions.

The annexes contain standard technical information that is frequently asked for. The list of firms known to manufacture and/or trade in audio-visuals is not exhaustive.

The manual was prepared for the United Nations Industrial Development Organization (UNIDO) by John Halas and Roy Martin-Harris, both award-winning, independent audio-visual producers in the United Kingdom of Great Britain and Northern Ireland who have also carried out projects in developing countries.

The views and opinions expressed in this publication are those of the authors and do not necessarily reflect the views of the secretariat of UNIDO.

Explanatory notes

CCTV	Closed-circuit television
GPO	General Post Office
Hz	Hertz
VCR	Video cassette recorder
VTR	Video tape recorder

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Part one

USING AUDIO-VISUALS

I. First principles

For centuries it was believed that words were superior to visual images in communication and that they involved a higher level of intelligence and thought. Education in developed countries is still firmly rooted in this belief, and the production of visual materials such as films, diagrams, and picturegrams is often held to be a craft activity quite separate from the process of thinking—even though great scientists of the past like Galileo, Copernicus, Newton and Leonardo da Vinci, who sowed the seeds of modern technology and mathematics, expressed their thoughts to a large extent through visual images and symbols.

It is well known that in the areas of the world where the supremacy of the written language is not dominant, the tradition of visual communication is stronger. In many countries expression through drawings and pictures has always been the means of handing traditional crafts and skills on to the new generation.

Young children all over the world express themselves through drawings and paintings before they learn to read and write, which professional teachers should realize, but unfortunately not all do. There are still many who teach exclusively through the use of conventional textbooks; only comparatively few take advantage of audio-visual aids.

Most "audio-visual" aids are in fact visual aids only. The difference between audio and visual aids is that a teacher can make a visual aid into an audio-visual aid just by talking, whereas he would have a hard job to draw on the chalkboard (blackboard) fast enough to keep up with an audio aid! Audio-visuals in their most modern form—the moving picture with sound—have been used ever since the invention of cinematography. Until the arrival of "talkies", the sound was provided by teachers themselves—and still is with many modern 8mm film loops. The growth of audio-visuals has largely related to the development of picture production.

The use of film as a means of training, apart from entertainment, rapidly expanded during the First World War. Nevertheless, it became a universally appreciated medium only with the introduction of the 16mm and eventually the 8mm film in both standard and super format.

The production of inexpensive projectors in 16mm and 8mm sizes enabled schools, training institutions and industrial organizations to own and operate them without employing a professional projectionist. It also meant that well-made documentary and instructional films were readily available at any given time on their own premises.

One of the successors to the early magic lantern, the filmstrip and slide, became more sophisticated by acquiring synchronized sound, and firmly established itself as a basic audio-visual tool. So, too, has the overhead projector, which is used alongside numerous variants of the conventional chalkboard.

Perception and memorization

Whatever process an audio-visual message goes through—electronic, photographic or magnetic—before it reaches the student, the most important factor about it is that it appeals to both the eyes and the ears. To make the best use of audio-visual techniques, it is necessary to know the procedures by which perception can be clear and memorization as complete as possible.

Some research maintains that man retains generally 10 per cent of the information he reads, 20 per cent of what he hears and 30 per cent of what he sees. He remembers 50 per cent of what he hears and sees and 70 per cent of what he hears, sees and then discusses. Another study has indicated that the use of audio-visuals can reduce required learning time by 40 per cent and increase retention of the information by 20 per cent. These studies are an important validation of audio-visual techniques.

It is even more important to know the procedures by which audio-visual techniques can be most effective. There has been some research into these problems in many continents but there is much more to be learned. One must also make specific allowances for differences in retention among groups in different parts of the world.

Major industrial corporations, such as the Ford Motor Company and the Kodak Company in the United States of America and Shell Petroleum in Europe, have also engaged prominent scientists to study the effectiveness of audio-visual instruction.

The range of tools

Owing to the wide range of hardware available, the choice of the right tool is no mean task. The choice of software may be even more difficult. Here there is a genuine shortage of material to suit the presentation in most teaching situations.

Before considering the range of audio-visual tools in detail, it may be useful to divide them into two major sectors: *(a)* mechanical aids; and *(b)* non-projected aids. The first category consists of filmstrips, slides, tape recorders, record players, overhead projectors, diascopes, episcopes, radio and television and all types of motion picture. Electricity is essential to provide the power to use most of these. Non-projected aids consist of various types of display boards such as chalkboard, markerboard, flannelboard and magnetboard. Non-projected aids do not require power and therefore may be more convenient in some circumstances; but they do require the lecturer's continuous presence and their effectiveness may depend on his personal performance.

II. Selection

Figures 1, 2 and 3 express graphically the principles of selection. Figure 1 shows that training is often the last resort in solving production problems, figure 2 that training by programmed instruction involves a great deal of preparation, and figure 3 that selection of media is often the last decision to be taken in designing learning programmes.

So by the time you choose the media necessary for implementing a learning programme well, the problem that led to the learning programme has probably been dealt with by many people in the organization. You are their "last chance"–and this gives you special responsibilities and privileges. First of all, it gives you the duty to say that if you think an audio-visual programme will not work in a particular context, there is no point in selecting media for it. You have to have the courage of your convictions, even when they are negative. And your superiors must accept that they have given you a responsible job that gives you the right to say no.

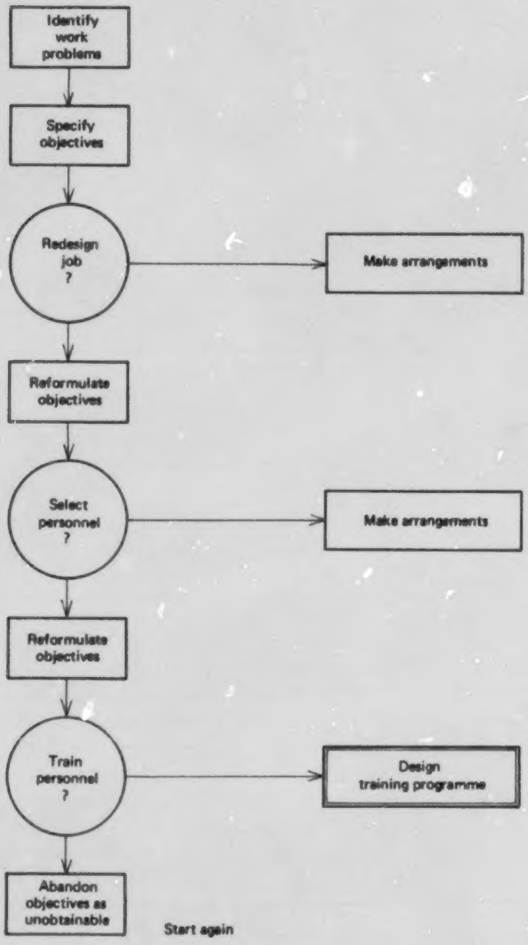
Identify work problems
Specify objectives
Redesign job ?
Make arrangements
Reformulate objectives
Select personnel ?
Make arrangements
Reformulate objectives
Train personnel ?
Design training programme
Abandon objectives as unobtainable
Start again

Figure 1. Procedural model of a training officer's job

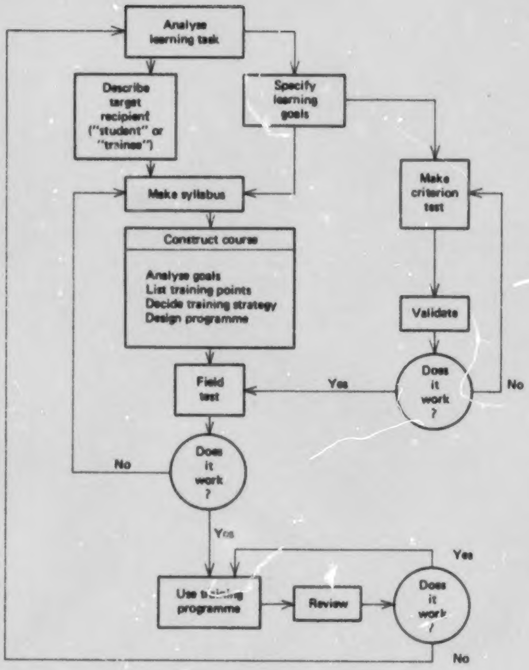
Analyse learning task
Describe target recipient ("student" or "trainee")
Specify learning goals
Make syllabus
Make criterion test
Construct course
Analyse goals
List training points
Decide training strategy
Design programme
Validate
Field test
Yes
Does it work ?
No
No
Does it work ?
Yes
Yes
Use training programme
Review
Does it work ?
No

Figure 2. The systems approach to designing training programmes

The range of training needs that can be met with judicious use of audio-visuals is infinite. The most frequent problem for the audio-visual trainer is an absurd one, but it is the one that occurs everywhere–from the lecture hall in the biggest and most sophisticated corporation to the village class-room. It is that nearly all trainers ignore the order of priorities indicated in figures 1-3 and select the media before they know what has to be communicated, that is, they choose the tools before they know what the job is.

One reason why the problem arises is that people think of mechanical teaching aids as toys. They enjoy

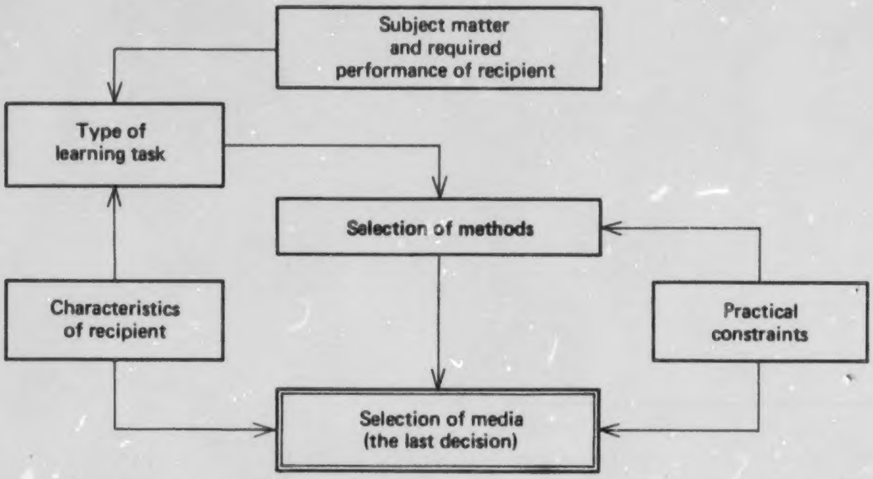
Subject matter and required performance of recipient
Type of learning task
Selection of methods
Characteristics of recipient
Practical constraints
Selection of media (the last decision)

Figure 3. Factors influencing selection of media

playing with projectors, teaching machines, closed-circuit television (CCTV) and all the other sophisticated aids to learning that have been marketed in the last few years. This happens at the highest level of industry. The senior training manager of a large British public corporation once had to give a talk on teaching machines to top executives. He made the mistake of displaying the teaching machines while he was talking, with the result that his audience looked the machines over and did not hear a word of his warnings about them. They all bought the teaching machines, and five years later most of them were lying in cupboards, unused. This waste of many thousands of dollars can be attributed to the training manager as much as to the executives.

It is the duty of the audio-visual trainer to keep management informed of the uses and drawbacks of the various new audio-visual tools; and it is his privilege to choose the right tools for the job—but only after he knows what the job is!

The first essential, then, in selecting audio-visuals is to make sure that your role as audio-visual trainer is clearly understood within the organization. It is your job, and nobody else's, to select the tools that will best meet the organization's needs. Without this basic responsibility, your hands are tied and you can have only a very limited effectiveness.

Once this first problem has been overcome, the charts shown in figures 1-3 offer good guidelines for actually selecting tools. The particular characteristics of each tool are described in part two.

Figure 1 expresses an educational technologist's view of the place of training in problem solving and should be used as background information. Figure 2 expresses the principles of programmed instruction, also for background purposes. Figure 3 expresses graphically the relationship between the factors involved in selecting media. These factors are the subject of this chapter.

Practical constraints

Some points that must be considered when using audio-visuals are:

- Availability of support materials (chalk, pens, transparencies, film cans)
- Availability of spare parts (bulbs, fuses, lenses, motors)
- Availability of compatible software
- Supply of electricity
- Space available—shape and size of room or building
- Light, heat, humidity and ambient sound
- Availability of maintenance, supply and security staff

The availability of support materials—materials that are in themselves simple, but are made and distributed by specialists—will largely depend on the smooth organization of transport to the audio-visual centre of all necessary materials and on the maintenance of an adequate reserve store on site.

To keep an adequate supply of spare parts on hand is usually a greater problem. Before you buy a machine, you must ascertain whether the spare parts and servicing are available in your part of the world throughout the working life of a machine. Every year companies make their old models obsolete, small companies close down, and a few thousand more machines are consigned to the cupboard or the dustbin. There can be no guarantee that the machines you buy will still be serviceable in 10 years, but several measures can be taken so that your machines will continue to work for their expected life-span, the most important of which is to maintain a store of spare parts and a technician who can repair most breakdowns. Unfortunately, in the case of sophisticated equipment, maintaining this store can be prohibitively expensive, and it may be better to employ a firm of unbiased educational consultants to choose your hardware. If that is too expensive, interrogate the salesmen of the hardware companies about the parts and servicing of their machines and trust your own judgement.

The software problem can be very difficult to solve, since the availability of the appropriate software cannot always be guaranteed. A machine without software is as useless as one without a spare bulb or a supply of electricity. The ideal solution would be to produce the software yourself, and this manual suggests ways of doing so. If such production is not possible, apply for the catalogues of the leading educational and teaching film producers, who usually list the various subject areas and may have just the software you need. The other problems are more general and will be considered later. What is essential is that practical constraints define the framework within which you can work. If you ignore any of them, you court disaster.

Subject matter, required performance of recipient and type of learning task

Programmed learning

Once you are fully aware of the practical constraints, the selection of methods is based on the subject matter and the required performance of the recipient, which will lead to an analysis of the type of learning task (depending on the characteristics of the recipient).[1] The principles leading to the selection of methods will be those of educational technology and then the selection of media will be based on the selection of methods and also on the characteristics of the recipient.

Educational technology is now a huge field, in which psychologists, educationalists, manufacturers and users (in industry and formal education) are all heavily involved. At the same time, it is a very young and unstructured science, which has not yet led to many practical applications. The most valuable concept that educational technology has yet produced is that of programmed learning (see figure 2). Educational technology is becoming more and more valuable to industry as its practitioners become more experienced. However, the ideas of programmed learning are too complex to be dealt with here. They are mentioned, first, to alert audio-visual trainers to their potential importance, but, secondly, to show that many of them cannot be drawn upon in using audio-visuals in industry. Programmed learning can be effective only if there is a precise subject matter to be understood or a performance required by the recipient at the end of the day. That is, programmed learning is relevant to training, instruction and education in that it helps to inculcate particular skills and attitudes, but not so appropriate to displays and exhibitions, promotion, research and development or any kind of dissemination of information when feedback from recipients is not analysed. In short, industry needs audio-visuals for advertising, information, entertainment and broadly "educative" communication as well as specifically "educational" programmes.

Non-programmed learning

For non-programmed learning, the type of learning task shown in figure 3 is irrelevant, and the selection of tools for various categories of communication become more subjective. The suggestions given below for selecting tools for these categories are guidelines only.

Displays and exhibitions

Displays and exhibitions are both categories of communication where the recipient has to be motivated. He is free to stop and watch (and listen) or to pass by. Thus, the presentation must be highly attractive and hold attention. Visuals must be eye-catching, and recorded sound (if used) ear-catching. The designer of the display or exhibition has to spend most of his energy in making the message appealing–and this means that he omits detail, but appeals strongly to the senses. The presentation has to be slick in a way that a training programme is not–it appeals to the recipient as a person rather than as a professional, so it can use techniques that might seem crude or gimmicky in a class-room. At the same time, a successful display is not remembered for its stunning appeal to the senses–its message must be communicated. Thus, the tools to be used for display purposes must be chosen for their capacity to entertain and inform the recipients. A clever gadget that was bought without regard to educational technology may come into its own in a display. Visuals will be dominant, and the use of words fairly limited. Posters, blown-up photographs, models, automatic slide projection and loop films are all very effective. Hand-outs or free samples can be available to make the recipient "take the message home". In short, tools for displays and exhibitions can be chosen for qualities that are rejected in training programmes.

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[1] The "recipient" is the trainee, the student, the pupil or simply a member of the audience.

Promotion

Promotion is a category in which displays and exhibitions are a part. Displays and exhibitions can be used within an organization to keep employees aware of safety requirements, the scope of the organization, new technological information, administration procedure etc. Promotion refers to an organization's publicity to the outside world. However, in large organizations many of its functions are dealt with by external specialists–graphic designers, advertising agencies etc.–and these functions are unlikely to involve the audio-visual resources within the organization. These are cases in which sophisticated promotion techniques are implemented from within–for instance, an organization in the United Kingdom runs courses for senior officers on how to act in a television interview–but these are exceptional. On the whole, the audio-visual trainer's role is restricted to an advisory capacity except in local, specialized or unclassifiable categories of promotion, where local conditions are so important that no general guidelines are possible. However, there are trends in this category that deserve consideration when tools are selected.

The sponsored film, a film financed by a company because its subject matter relates directly or indirectly to the company's product, is one ever-popular promotional device, but it is now less important than it has been in the past. Some films become dated quickly; and if they are still in circulation a few years after they are made, the old-fashioned construction of the film can create a negative impression. This is less true in animated films than in live-action films, but graphics and cartoon styles are also ephemeral.

A partial replacement for the sponsored film is the multi-media package for use in schools and colleges. The package can include a film, but more often a filmstrip or tape slide film, booklet and wall charts. It contains information about the originating organization in educative rather than image-building terms, but can be very effective in creating awareness and interest.

Multi-media packages are also being used quite extensively by manufacturers to inform dealers and distributors of new products. A kit from an automobile manufacturer announcing a new range of cars to their dealers may include two filmstrips, a long-playing record, a brochure containing photographs of the car from every angle with a description of relevant sales points, and a preliminary service information manual. The use of such audio-visual tools in this context creates a stimulus, provides extensive information and shows the manufacturer's concern for the dealer's problems.

In general, the criteria for promotional audio-visuals are the same as those for displays and exhibitions. The approach must be bright, sympathetic and modern above all, but the message must be clear.

Research and development

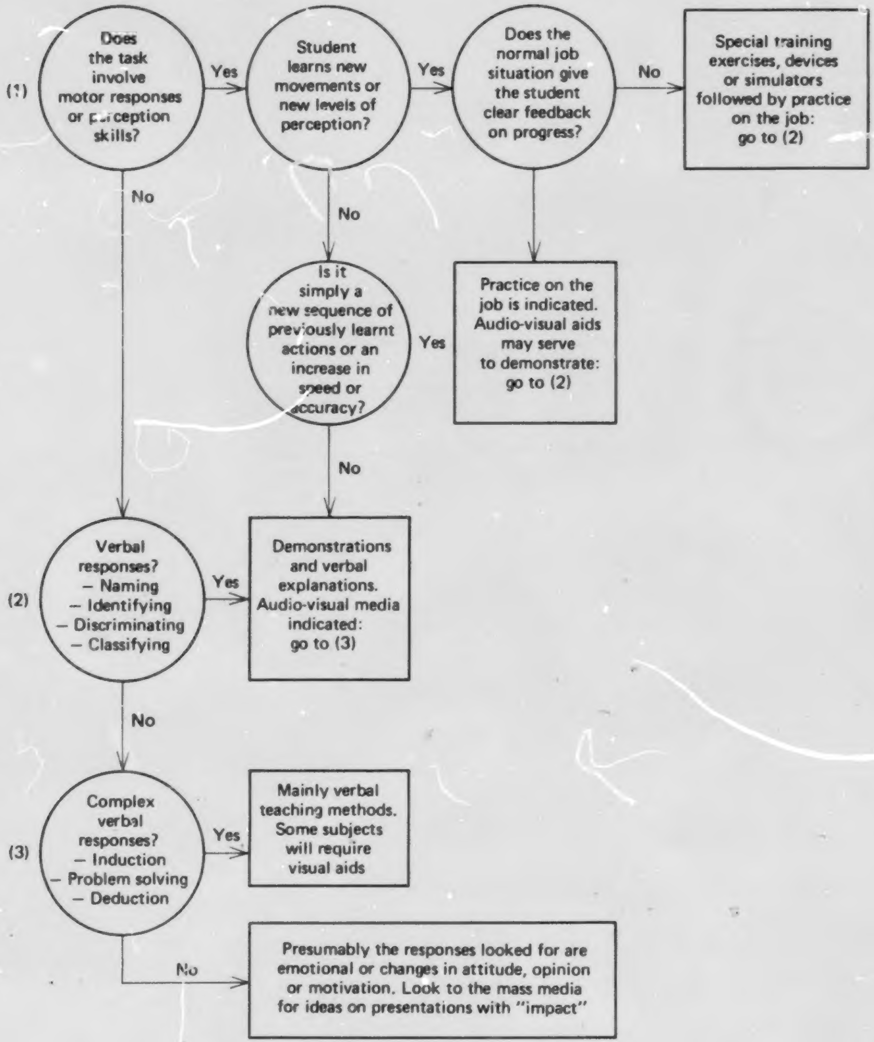
In research and development, audio-visuals are used primarily as recording devices. Glossy presentation is irrelevant; accuracy and detail are all-important. Cameras and tape recorders can be used to magnify, condense or reproduce images and sounds in time and space (using close-up and long lenses, omnidirectional and unidirectional microphones, fast-running film or tape to create an illusion of slow motion, time-lapse photography to create an illusion of fast motion). The use of cameras and tape recorders must be controlled entirely by the researcher, subject to the technical limitations of the equipment the audio-visual trainer can provide. The presentation of evidence recorded in this way will depend on the characteristics of the recipient and on practical problems. It may be that images recorded in motion need projection as still images. The stop-frame device of a film projector or a video recorder may do the job, or the image may have to be rephotographed for permanent access as a print or transparency. It may be that movement does not need to be recorded, in which case a slide projector will be sufficient, and graphics can indicate the actual movement. For specialized work (slow motion, time-lapse etc.), variable-speed motion-picture playback may also be necessary. As most projectors run only at 16, 18 or 24 frames per second, it may be better to have a viewer that can provide varying speeds of viewing even though the images are small. Several cine projectors are available with slower projection rates and stop frame.

Visuals also play a large part in retrieving information for research purposes. Research reports from the National Aeronautics and Space Administration (NASA) of the United States of America that apply to many fields outside aeronautics are easily available in microfiche form, and the lead of NASA has been followed by other big research organizations. Thus, microfiche and microfilm viewers may be essential equipment for the library. Many scientific journals are also available in either hard copy or microfilm.

There are many other applications of audio-visuals in research and development. The audio-visual trainer may have to prepare graphics for reports, assist at conferences and play a large part in preparing experiments requiring an audio-visual recorder.

Other

Any ways in which audio-visuals affect people's lives may be of relevance to the audio-visual trainer. His equipment may be used for entertainment at social events and for general education. He may be concerned with the development of broadcasting (radio or television) in his part of the world. He may work with national or international educational organizations or be involved in local community development. An audio-visual trainer can serve his industry in many ways apart from his training programmes, and his selection of tools will depend on the individual situation. Nevertheless, his main job is training, and all of his expenditure on resources will primarily be for training purposes. Moreover, most of the criteria by which he selects tools for training will apply equally well in other areas. For instance, figures 4-7 can be used for promotional and general purposes as much as for training. In this context, all the remarks in this manual that refer specifically to training can be applied in other fields.


(1)
Does the task involve motor responses or perception skills?
Yes
Student learns new movements or new levels of perception?
Yes
Does the normal job situation give the student clear feedback on progress?
No
Special training exercises, devices or simulators followed by practice on the job: go to (2)
No
No
Is it simply a new sequence of previously learnt actions or an increase in speed or accuracy?
Yes
Practice on the job is indicated. Audio-visual aids may serve to demonstrate: go to (2)
No
(2)
Verbal responses? – Naming – Identifying – Discriminating – Classifying
Yes
Demonstrations and verbal explanations. Audio-visual media indicated: go to (3)
No
(3)
Complex verbal responses? – Induction – Problem solving – Deduction
Yes
Mainly verbal teaching methods. Some subjects will require visual aids
No
Presumably the responses looked for are emotional or changes in attitude, opinion or motivation. Look to the mass media for ideas on presentations with "impact"

Note: Consider questions 1, 2 and 3 in turn.
They may all apply to one learning task.

Figure 4. Programme for selecting teaching methods

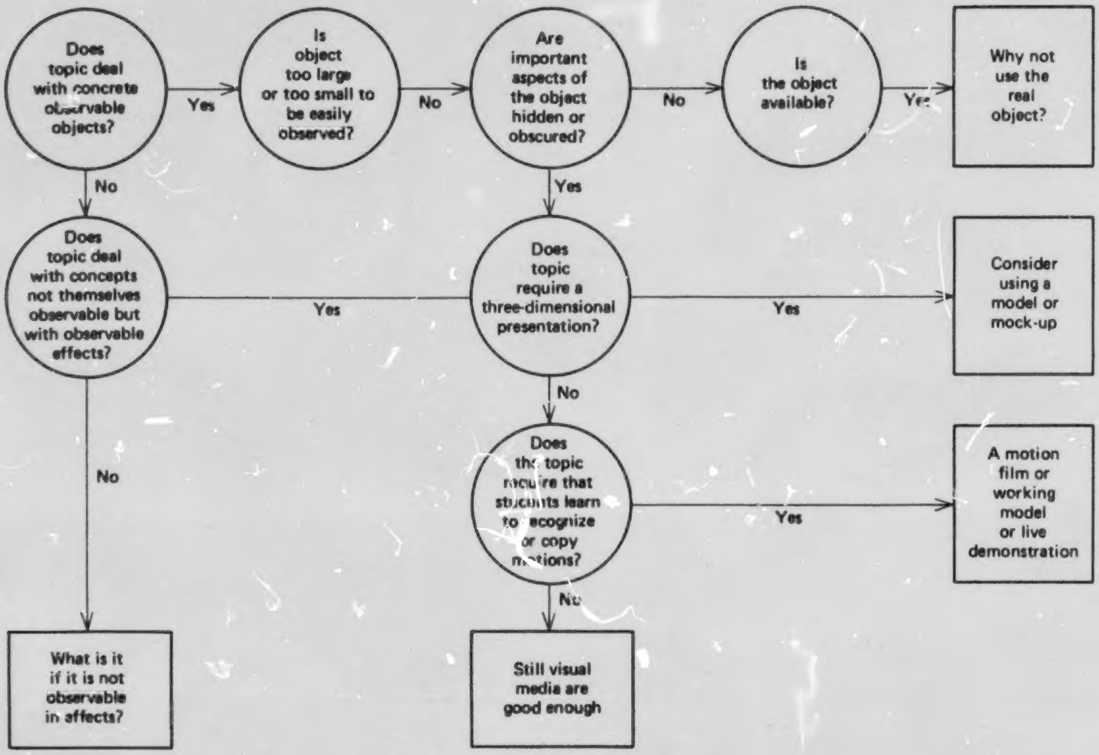

Does topic deal with concrete observable objects?
Yes
Is object too large or too small to be easily observed?
No
Are important aspects of the object hidden or obscured?
No
Is the object available?
Yes
Why not use the real object?
No
Yes
Does topic deal with concepts not themselves observable but with observable effects?
Yes
Does topic require a three-dimensional presentation?
Yes
Consider using a model or mock-up
No
No
Does the topic require that students learn to recognize or copy motions?
Yes
A motion film or working model or live demonstration
No
What is it if it is not observable in effects?
Still visual media are good enough

Figure 5. Programme for selecting visual media

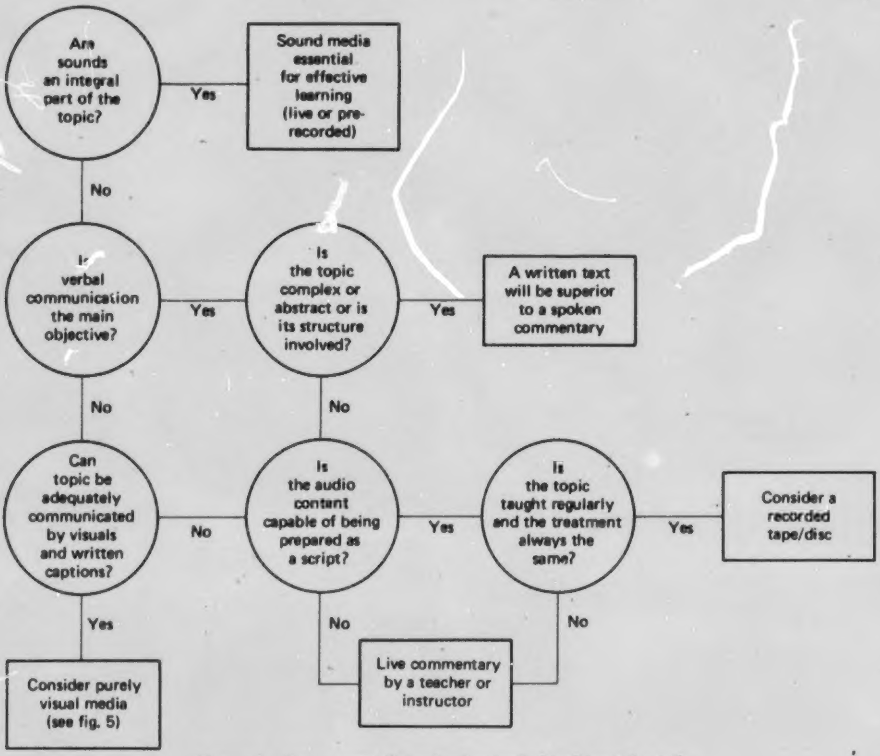

Are sounds an integral part of the topic?
Yes
Sound media essential for effective learning (live or pre-recorded)
No
Is verbal communication the main objective?
Yes
Is the topic complex or abstract or is its structure involved?
Yes
A written text will be superior to a spoken commentary
No
No
Can topic be adequately communicated by visuals and written captions?
No
Is the audio content capable of being prepared as a script?
Yes
Is the topic taught regularly and the treatment always the same?
Yes
Consider a recorded tape/disc
Yes
No
No
Consider purely visual media (see fig. 5)
Live commentary by a teacher or instructor

Figure 6. Programme for selecting verbal and sound media

If → / Then ↓	CHARACTERISTICS OF LEARNER RECIPIENT									REQUIREMENTS OF THE TASK								MATERIALS				TRANSMISSION				
	Large 100+	Medium 30–100	Small 2–30	Individual	Visual	Audible	Learner paced	Response	Self-instructional	Motion	Time (expand/contract)	Fixed sequence	Flexible sequence	Sequential disclosure	Repeatability	Context creation	Affective power	Obtainability	Reusability	Time to obtain	Cost (4 copies)	Simplicity (equipment)	Availability (equipment)	Controllability	Freedom from distraction	Darkening not required
Real object	▩	▩						▩			▩					▩						▩	▩		▩	
Model of real object	▩	▩						▩								▩						▩	▩		▩	
Live voice					▩		▩		▩	▩	▩				▩	▩			▩		▩	▩	▩			
Audio tape record					▩					▩			▩			▩										
Print						▩				▩	▩		▩			▩						▩	▩			
Programmed instruction										▩	▩		◩			▩							▩			
Chalkboard	▩					▩	▩		▩	▩	▩				▩	▩			▩		▩					
Overhead transparency				▩		▩	▩		▩		▩					▩										
Filmstrip						▩				▩	▩		▩			▩										▩
Slide						▩					▩					▩										▩
Motion picture													▩													▩
TV							▩						▩		◩				◩							
Flat picture	▩	▩				▩				▩	▩					▩						▩	▩	▩	▩	

▩ Not applicable ◩ Partially applicable ☐ Applicable

The matrix in figure 7 was designed by John G. Wilshusen, Jr., of Indiana University, with the assistance of Richard Stowe, State University at Plattsburg, New York, and is reproduced here with their permission.

Characteristics of learner recipient

Large, medium, small, individual—these designations refer to sizes of groups of learners.

Visual—the characteristics of the learner dictate that the stimulus material be visual.

Audible—the characteristics of the learner dictate that the stimulus material be audible.

Learner paced—the characteristics of the learner dictate that the rate of presentation be controlled by the learner.

Response—the medium contains provisions for incorporating demand for learner response.

Self-instructional—the characteristics of the learner dictate that stimulus materials be so designed that the learner is able to use them with little or no supervision.

Requirements of the task

Motion—the requirements of the task indicate that motion must be depicted.

Time—(expand/contract)—time refers to the possibility of expanding or contracting the length of presentation as compared with the real time taken by the same phenomena: e.g. slow-motion or speeded-motion pictures, compressed or expanded speech devices.

Fixed sequence—medium does not permit change in sequence of presentation beyond forward or reverse. Flexible sequence—medium permits change in order of presentation of stimuli.

Sequential disclosure—medium permits revelation of material bit by bit and allows retention of prior segments as further ones are revealed.

Repeatability—medium allows complete or partial redisplay.

Context creation—medium is able to transport learner from awareness of real world to immersion in context artificially contrived. Motion pictures are an obvious example, but all media may have this capability to some degree. A book has it, for example.

Affective power—all media have the power to move people emotionally to some degree.

Materials

Items in this group are reasonably clear, but feedback assessment from local users will be required.

Transmission

Simplicity—how simple is the equipment to operate?

Availability—how readily available is the equipment required to display the stimulus materials?

Controllability—how much control over the transmission can be exercised by the instructor? (Start/stop, slower/faster, freeze frame, volume change, forward/reverse, repeat, switch to different medium.)

Freedom from distraction—to what extent does the equipment distract the learners from the intended stimuli?

Darkening not required—medium can be presented without darkening the room.

Figure 7. The "if-then" matrix for selecting media

Characteristics of the recipient

One of the major tenets of programmed instruction is that the content of a training programme is measured by the difference between the performance required of the recipient and the learning level of the student when he enters the course. The "characteristics-of-the recipient" factor in media selection includes his learning level both in terms of his knowledge of the subject to be taught and in terms of his communication skills (linguistic skill, literacy, numeracy and "graphicacy"[2]); and his cultural, ethnic, social and psychological background, which is governed by local conditions.

Of course, for practical purposes these factors have to be measured very roughly, but must be considered in selecting the methods of instruction and, most important, the media. Even though the methods are precisely tailored to the recipient's learning level and local conditions, they will not bring results if the media through which they are presented fail to speak in the recipient's language—including the language of numbers and pictures. If to the language difficulties are added the problems arising when someone with little experience of technology is confronted with an industrial environment, it may be impossible to teach anything at all.

The selection of media has to take into account the advantages of using particular media against the disadvantages of having to translate their unfamiliar language. In all cases, the instructor has to direct the curiosity of his students towards relevant subjects.

In an extreme case, some of the trainees may have never seen an instrument or machine like the one they are being trained to operate. The whole exercise may lie beyond their experience and comprehension, and one technique should be used exclusively, although a variety may regenerate interest. In such a situation the tutor must evaluate the intelligence, maturity and experience of the members of his audience to determine how much of the information presented they will retain.

A presentation should be constructed so that it will relate to the learner's general experience. Students from an agrarian background find it more difficult to understand technology than students who have lived with it all their lives.

The introduction of new equipment, products and processes is often not related to local conditions. It is however, important to relate a presentation to the environment in which it is used, and the material presented should be conceived from this point of view. Strong illumination, strong contrast of light and darkness as opposed to soft shades and shadows, would be in keeping with the environmental conditions in tropical countries.

Good visibility and simplicity help clarity and perception. The main features being presented must stand out clearly from the background; the field of view must be well placed, allowing for sustained concentration without interference. The audience must be given plenty of time to look and absorb the material, especially if it is unfamiliar. If verbal and written elements are used in association with the material being presented, comprehension and memorization will be affected and here again clarity and relevance must be taken into consideration. The audience's verbal comprehension and reading capacity must be evaluated. If not, interest is lost, attention is distracted, and the learner is prevented from grasping the subject.

Trainees must feel familiar with their learning programme, and a photographic presentation with precise and accurate description can help them to become familiar with it. However, for detailed and specific information—used to explain complex equipment, for example—simplified or stylized drawings or animated diagrams can provide a clearer definition.

Much educational material depends on the use of symbols and codes that are unknown to an audience. Signs such as directional arrows, lines and symbols to represent time and space, or elements like force and wind, need to be made familiar. Once grasped, such information can be understood and assimilated without any specific training. On the other hand, there are certain difficulties in understanding even the most uncomplicated pictorial material. Simple signs representing distance, converging perspective lines and the superimposition of objects in perspective can be incomprehensible if not explained beforehand.

On the whole, locally produced material, which takes full account of the familiar environment and the level of intelligence of the learner, is preferable to material brought in from the outside. This applies mainly to software because in most cases the hardware can be obtained only from appointed dealers.

Printed brochures, leaflets and books can no longer be considered the most efficient means of conveying technological changes, particularly in territories where reading and writing are not traditional. Instruction that relies on the printed word is likely to be ineffective without some form of audio-visual help where visual communication has already been established, in television and cinema, as a part of everyday life.

In spite of the available range of audio-visual aids that can, if wisely chosen, suit practically every occasion, there are still too many learning programmes that are abstract, academic, confusing and dull. The proper use of audio-visual aids can make a presentation vivid, interesting, concrete, and from both the trainer's and trainee's point of view, highly economical.

As was explained earlier, the use of audio-visual techniques does not depend on expensive equipment.

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[2] "Graphicacy", or visual literacy, is the ability to decode information from pictures, e.g. following conventional perspective, "reading" a picture left ↔ right, up ↕ down, understanding visual symbols.

Simple aids used expertly can be an asset to any organization. It may be better to spend money on training more trainers than to invest heavily in hardware, although it will take longer to train trainers to use simple aids effectively than it will be to teach them how to use a film projector. Trainers of the right calibre are often not available, whereas equipment that reduces the burden for one man can make him many times more efficient. Unfortunately, the expenses of maintaining equipment, obtaining software and constructing any sort of media resources centre are hidden costs that may well exceed the cost of importing trainers from another country at high salaries.

Although it can be a great stimulus to education, the rapid development of modern technology can be more of a hindrance than a help. If the supply of electricity is uncertain, the support systems that complicated hardware requires may be impossible to maintain. If the cultural level of the recipients is radically different from that of recipients in developed countries, most software imported from developed countries may be useless or even harmful. An audio-visual instructor is not a man with a machine–he is a man trained to present information audio-visually; but whether he uses chalk and talk or CCTV, he has to be an expert in audio-visual communication.

In the right hands, a chalkboard or a flipboard can be more valuable than any other aid. A mixture of voice, writing, drawing and erasing can provide audio-visual information and stimulate efficient learning. The chalkboard is cheap, durable and can be used anywhere. No software is needed, only a trainer who can use the chalkboard or a flipboard to its full advantage–and such persons are rare.

Nevertheless, simple aids are the first essential on any trainer's shopping list. A bad teacher may be only 10 per cent efficient, but a broken-down film projector is totally useless.

The argument for using simple aids does not rest on the idea that the messages transmitted by them are easier to understand than the messages transmitted by elaborate aids. In fact, it is much easier for an uneducated person to understand that he must copy the people he sees in motion pictures than it is to understand the combination of words, numbers and pictures he sees on a blackboard. Because the most sophisticated aids can bring the messages that are closest to real life, they can easily be used in teaching illiterate people.

The technology of using sophisticated aids (as opposed to that of making and maintaining them) is much easier to master than the technology of using simple aids (and compensating for their lack of reality). Ten-year-old children can learn to operate a CCTV camera and video tape recorder without difficulty, and they can show a video tape of themselves performing a task far more easily than they can explain verbally what they did. A Maharishi who completely renounces technological society nevertheless is now sending video tapes of his meditation techniques to his disciples.

The characteristics of the recipients are the most complex factors affecting the choice of tools. A student may be distracted by a machine, but relate well to the pictures and sounds it emits. He may understand a chalkboard, but be confused by what is drawn on it.

Evaluation of cost-effectiveness

When a trainer uses only simple aids and homemade disposable software, the cost-effectiveness of the training programme can be computed in terms of the value to the organization of workers after training as against the cost in manpower and facilities of operating the training programme. When more elaborate media are being considered, the evaluation of cost-effectiveness is a much more complex procedure. There is not yet any widely accepted methodology of media evaluation.

Many variable costs are involved in selecting media on a long-term basis, but elaborate media usually justify a high initial cost because of the substantial long-term return on investment. If you use a chalkboard, you have to do the same amount of work every time you use it to present information. If you use more expensive equipment, you can usually use the same software again and again, which substantially reduces many labour costs and brings other advantages.

The relative costs of equivalent media depend on the amount and type of instructional content that needs to be produced and how often that content is to be presented or repeated. Production, presentation and repetition are key factors; each should be computed separately but considered together.

III. Use

So far we have been concerned mainly with acquiring and maintaining the right sort of audio-visual tools for the right sort of job. All this preparation is essential, but the test of your selection of media is in their application on the shop floor, in the class-room or in the lecture hall. There is where your theories are put to the proof, where you can check your evaluation or all your background information, and where you are actually communicating to the trainee.

Communication consists of three separate, but entirely interdependent parts, which can be called:

Message
Channel
Recipient

The message is the information you want to give. The channel comprises all the media and methods used to make it clear—whether your voice in a class-room, or the projection of a film that has been exposed, processed, printed, edited and dubbed with sound. The learner (recipient) receives the message through the channel, and any deficiencies in message or channel will be reflected in his imperfect subsequent performance. You may think you have a clear message and a perfect channel, but if the learner fails to understand the message, it is not really clear and the channel is not really perfect. In such a situation, the teacher, sensitive to the learner's problems, will use his skill to surmount them in any way possible. If that means abandoning a tape-slide programme for a chalkboard, it does not matter. The basis on which you set up the programme must have been incorrect, but in the meantime you must get on with the job as best you can.

In most situations there will be no need to change a carefully prepared programme at the last minute, but it is the quality of the preparation that matters, not the amount. There is no point in preparing a learning programme, a room, equipment and software if the end result is no improvement in learner performance. And the more sophisticated your tools are, the more preparation they need; and the disaster of an unsuccessful demonstration is all the greater. Although the necessity for abandoning prepared programmes in an emergency should be borne in mind, the rest of this chapter will be devoted to the practical ways in which the channels of communication can be as perfect as possible on the shop floor. In this context, the size and shape of the room, the light level, the heat, the ambient sound and the time of day will all help to determine how effective the channels will be.

Physical facilities

In the past it took a trainer 30-45 minutes to prepare a room and set up his equipment. Today it is easier to do and takes less time. When the projector with built-in screen as one unit is used or the new metallic type of screen, there is no need to darken the room. Strong projection lights through better designed lenses also help to make a more clearly defined projected picture, so that even front projection can be used in a semi-dark room and there is still enough light to see the students.

If projection takes place in the open air, special arrangements must be made. If the light interferes considerably, the screen must be shielded from it. (It is not necessary to shield the projector.) Availability of power is another factor. If there is no electric power, the portable battery, which should include a suitable DC to AC converter, will do just as well.[3] After all, motor cars use long-life batteries, which, if properly maintained, provide power for several months or even years. Whatever energy is consumed, however, must be replaced, and while a car can recharge its battery during running, the projector cannot. Consequently, with an efficient converter, some projectors can operate for up to 10 hours, or approximately 20 short periods of projection, after which it is wise to have even a long-life battery recharged.

The power supply driving the projector's motor must be at a constant speed to avoid light flicker, and, if sound is used, frequency fluctuation. These can occur if the battery is allowed to run dry.

Whatever the conditions, the audio-visual operator must check both the voltage regulation as well as frequency stability in order to use the equipment properly. He should also check the length of the power cords and cables. He must make sure that the correct plug is fitted in advance of the presentation and that some extra projection lamps are available. In extreme heat it is especially important to protect not only the equipment but also the films inside or outside their cans, since heat makes them curl up. If the equipment is left outside in the open air, it must be protected from heat and damp, which can damage it.

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[3] See G. Gordon Howlett, "Using projectors away from mains electricity", *Educational Development International*, vol. 1, No. 2 (July 1973).

When the lecture takes place in a building, the size of the room should be related to the number attending the lecture, and the acoustics taken into consideration. If the room is overcrowded, the physical discomfort impedes the lecturer and does not promote efficient learning. Very large rooms with a small audience can handicap the acoustics and impede concentration. Ideally, the environment for an audio-visual presentation should be specially constructed by an expert who can see that the power supply is correct, arrange the platform and desks for the students to take notes, and design the layout of the room to encourage direct personal contact between lecturer and students. Such a room can, if necessary, hold a maximum of 50 students, although 30 is preferable.

The room should not be smaller than 10 metres by 15 metres, and its height not less than 3 metres. Air circulation should be regulated and the acoustics good. For instance, concrete walls and floors and all other hard, reflective surfaces cause echoes and distort sounds, so that sound-insulating board and a felt or carpeted floor should be chosen. Safety is another factor—doors must be easy to open and access to them unencumbered. These are the minimum physical requirements for a place to be used for film shows or meetings. For frequent audio-visual demonstrations, it is much more convenient to have a room permanently equipped with the right facilities.

Application and follow-up

The purposeful application of audio-visual aids depends not only on good intention, willingness or interest in a new technology, but a degree of professionalism (i.e. knowing how to handle the equipment and how to make best use of it to stimulate learning). In developed countries teachers and future audio-visual operators wishing to acquire these skills can draw on extensive sources, which, unfortunately, are not available universally. Nevertheless, with common sense, careful choice of media and a will to experiment, any good trainer can apply audio-visuals imaginatively and intelligently. The scope of application is extremely wide in every form of audio-visual communication, whether the objective is information, training or teaching of a skill; and there are no hard rules for procedure.

It would be useful to restate some specific guidelines once again: the character of the group should be known, the most suitable type of aid selected, and presentation carefully planned. It is also useful to restate that a step-by-step presentation is better than conveying too much information too rapidly. Clear visual material is always essential. Practice with the actual equipment or tools is a great advantage; learning to handle the equipment while gaining an understanding of the theory at the same time is a more effective way of acquiring a skill than dealing with practice and theory separately.

A simple guide for using audio-visuals is as follows:

(a) For day-to-day information and announcements, use the display board or any other non-projected technique;

(b) For information requiring retention in the memory, use projected images, which, if available, can include film, television and slides;

(c) Preview all audio-visual software and make notes;

(d) Audio-visuals should be only a part in a series of lessons making up a study unit;

(e) Train another person to help operate the equipment;

(f) Audio-visuals should be used as teaching tools and not as time fillers;

(g) Make a clear definition of when and where the audio-visual aid is to be used;

(h) Follow-up, always important, should be considered an integral part of the programme. It should vary according to the purpose for which the trainer has used his audio-visual aids;

(i) Keep looking for better ways to use audio-visuals.

The main drawback to the last mentioned item is that most trainers are too busy implementing their methods to communicate them to trainers in other organizations.

Eventually, perhaps, there may be a system for exchanging information between training establishments, preferably at frequent intervals. Unfortunately, the difficulties in establishing such a system are theoretical as well as practical. The criteria for determining the relevance of one organization's audio-visual training methods to another organization are disputed by educational technologists throughout the world. Only when a measure of agreement among theorists has been achieved can practical experience be properly evaluated and communicated to the interested parties.

Designing facilities

In spite of the commercially available instant lettering, signs and shapes for magnet and flannel boards, a demonstration will almost certainly require the presenter to produce some designs in front of the class. The lecturer himself will have to synchronize the production of such visuals with the verbal presentation, and if he synchronizes the two elements well, the presentation will have a good chance of success. The production of visual graphics by the teacher is a vital element in the preparation of a demonstration.

Some elementary factors in design and graphics in the context of audio-visual presentation are discussed below.

Design means the creation of order out of chaos. It is the assembly of several visual elements into a graphic arrangement that will put across the main points of the demonstration to the learner directly and clearly.

The graphic arrangement should be fixed through the layout; the elements that have to be put into a harmonious whole are words, lines, colours, planes, space and texture. The tools to be used can be pencils, crayons, pens, inks, charcoal and brushes of all sizes. The layout is the co-ordinating factor that determines the basic format and composition of an image, and it should be prepared beforehand. Improvisation in front of the class can hold up the lecture and lead to a confusing mixture of drawings.

The proportion of lettering and writing should always be in balance with other visual elements in a composition and related to each other; only a layout can determine such relationships. In the meantime, the size of the visual elements can be defined—words must be clear and readable even from the back of a room; drawings should be reduced to their simplest elements. If a drawing needs complex visual effects, such as shading and texture, these should be prepared before the lecture so as not to interfere with the flow of the presentation.

The characteristic behaviour of various writing tools should also be studied. For instance, some pens that are good for fine work may be difficult to wipe off. Instead, coloured wax pencils may be more suitable, depending on the type of surface being used. The felt-tipped board-writers provide bold, clear lines, if such an effect is required.

A smooth visual presentation requires careful study of design techniques. The first step is not to choose too difficult an approach. It is valuable to produce some rough sketches in simple line drawings and bring up the images step by step in the context of the content and continuity of the lecture. The drawings or any element of visuals should not be considered on their own artistic merit, but should be an integral part of the whole presentation.

Although the display industry has concentrated on making the presentation of visuals, including graphics and lettering, functional and easy for the lecturer, the instant presentation in front of the class still has a magical effect on the audience. Some basic visual problems, however, like illegibility, are proving difficult to overcome. Illegibility can destroy any presentation, and for this reason this problem is discussed at length in the next chapter. Finally, the lecturer does not need to be a skilful designer or artist himself, and yet, with a little background study in design, he can communicate his programme with the maximum effect.

Administrative aspects

Many of the essential preparations that should be made before an audio-visual learning programme is embarked upon have already been mentioned but not the administrative organization for making them. Often, the audio-visual trainer may be the only member of the audio-visual section of his organization, and perhaps the only member in the training section, too. He has a lonely, specialized job, which inevitably involves more work than his colleagues would believe possible.

Some of the functions he must fill are:

(a) Keeping abreast of company policy, particularly training policy;

(b) Keeping up to date with information on new equipment, software and industrial training practices;

(c) Evaluating training needs, characteristics of recipients and practical constraints, then planning training programmes (unless there is a training officer);

(d) Selecting media for training programmes;

(e) Evaluating, buying, maintaining, servicing and storing equipment;

(f) Buying or preparing, designing and making software;

(g) Careful costing and planning ahead;

(h) Creating a media-development plan;

(i) Training a colleague to take over in emergencies;

(j) Implementing programmes;

(k) Evaluating results, planning new programmes;

(l) Keeping colleagues informed of the state of the programme at all stages.

This burden on the trainer can be eased in several ways, even within the resources of a small organization. First, assistance may be available from government and international industrial development agencies, which may take the form of money, specialist advice, or even a ready-made training programme for particular needs. Secondly, existing staff can be used to handle some of the work. If there is a draughtsman or a chart writer, he can make visual software. The electrician can also be responsible for maintaining electric equipment, and carpenters or metal workers can make and repair other equipment. Thirdly, trainees can operate audio-visual aids during the training programme and assist in preparing rooms etc. Fourthly, the interest of colleagues and superiors should be maintained. Most people have some interest in audio-visuals, if only by association with entertainment cinema, and will often provide support when it is needed.

Figure 8 shows the possible organization of a small audio-visual department. Film and television units are less essential than the photographer and the

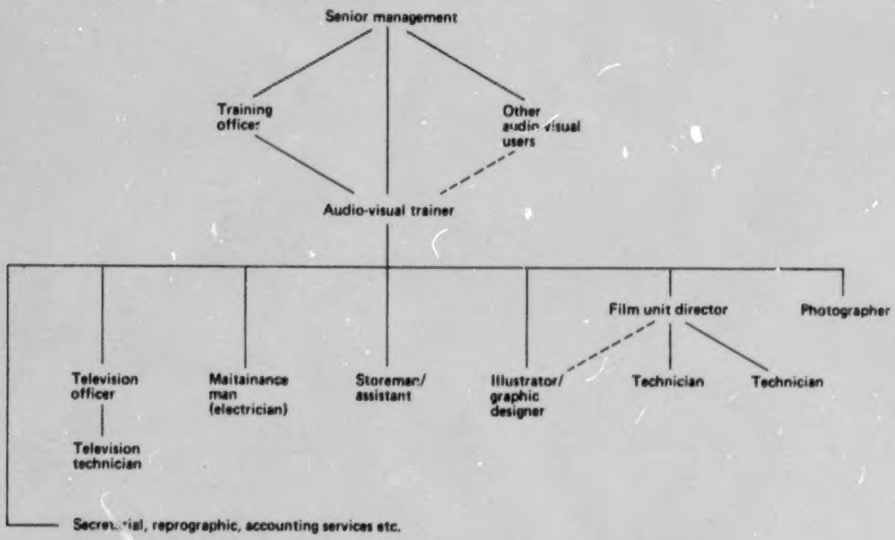

Senior management
Training officer
Other audio-visual users
Audio-visual trainer
Film unit director
Photographer
Television officer
Maitainance man (electrician)
Storeman/assistant
Illustrator/graphic designer
Technician
Technician
Television technician
Secretarial, reprographic, accounting services etc.

Figure 8. Organization chart for a small audio-visual department

illustrator; the illustrator is more important than the photographer; the maintenance man and the storeman can be more important than an illustrator. In many cases, with competent training and advice, many lecturers can prepare their own visuals.

The physical shape of the audio-visual department will vary widely from place to place. It should be as far as possible a self-contained unit, in which the audio-visual trainer has immediate access to staff, tools and trainees. At the same time, it must be seen as an integral part of the organization, and preferably not situated in an obscure corner nobody can find.

The four most important functions of the department are production, presentation, maintenance and storage. Each should have its own room or rooms, although certain kinds of combinations can work well. For instance, the tools used for practice by trainee fitters, electricians and mechanics can be stored in the maintenance area and used for the upkeep of projectors and other equipment; but stationery and software must be kept somewhere else.

Part two

TECHNIQUES AND TOOLS

IV. Basic considerations in preparing materials: from artwork to screen

One of the best ways to lose audience attention during an audio-visual presentation is to project material that is not legible to the entire audience. If a speaker has to say, "You probably can't read this from where you're sitting, so I'll read it to you", his presentation suffers from too little planning.

Planning legibility of projected artwork

Once the objectives and the strategy of a talk have been planned, consideration can be given to the size of the anticipated audience and to any unusual features of the projection facilities. Only then should the artwork be designed. If a presentation is to be successful, original art must be prepared with those sitting in the rear seats in mind.

Experience has shown that:

(a) Artwork can be planned and executed to permit the visuals to be legible when projected;

(b) There are advantages in establishing uniform sizes for artwork and making these sizes standard;

(c) Although the letter height can ordinarily be a minimum of 1/50 the height of the information area, the use of a larger letter height (1/25 or larger) is strongly encouraged;

(d) The use of a legibility calculator provides an easy way to determine the minimum artwork letter height needed for legibility at various viewing distances (see figures 15 and 16).

Legibility requirements

To be legible, lines, letters and symbols should contrast adequately with the background; there must be distinct separation of tones; and the colours selected should be strong and attractive. Tonal contrast is particularly important when preparing artwork for television where the television receiver may display the coloured artwork in a black-and-white mode. Additional comments on this format can be seen in figure 9.

Letters and symbols should be bold and simple, with no small openings that will tend to fill in when projected. All elements such as lines, letters, symbols and figures must be big enough to be seen easily by everyone in the audience. Therefore, these elements have to be at least a certain size on the screen, the size depending on the height of the artwork area in relation to its distance from the farthest viewer.

In typical viewing situations–screen-to-viewer distances ranging from short (in small conference rooms or in homes) through medium (in class- and meeting rooms) to long (in large auditoriums and theatres)–the maximum viewing distance should be about 8 times the height of the projected image. To put it another way, if the projected material is legible for the farthest viewer, who is seated 8 times the projected image height from the screen, it will be legible for all other members of the audience. This maximum viewing distance (expressed as 8H) can be used in determining the minimum size of significant detail in the material to be projected.

Testing existing material for legibility

When material that was not designed for projection (printed graphs, charts etc.) is to be converted to a projected visual, remember that contrast, colours and viewing distance may change, but the requirements for legibility will remain the same.

It should be noted that 8H viewing is a generally accepted standard. If the letter size suggested for 8H viewing is doubled, the projected image will be legible from twice the distance, or 16H. The 8H concept also assumes average or slightly below-average eyesight of the viewer. For 8H viewing, an average viewer can judge legibility by looking at the material to be copied from a distance 8 times its height. For example, consider a printed table that is to be photographed for projection. If the table is 3.5 in. (88 mm) high, it should be viewed from 8 times that height (28 in. or 0.7 m) to see whether it is readable. If it is, the type size will be suitable for copying and projection. The same principle applies to larger work. A wall chart or a map 4 ft (1.2 m) high requires legibility at a distance of 32 ft (9.6 m) if it is to be acceptable as a projected image for 8H viewing (8 X 4 ft = 32 ft). If the material is not legible at the test distance, it should either be redrawn or discarded.

Subject content as well as image size affects legibility. If the work you are photographing is

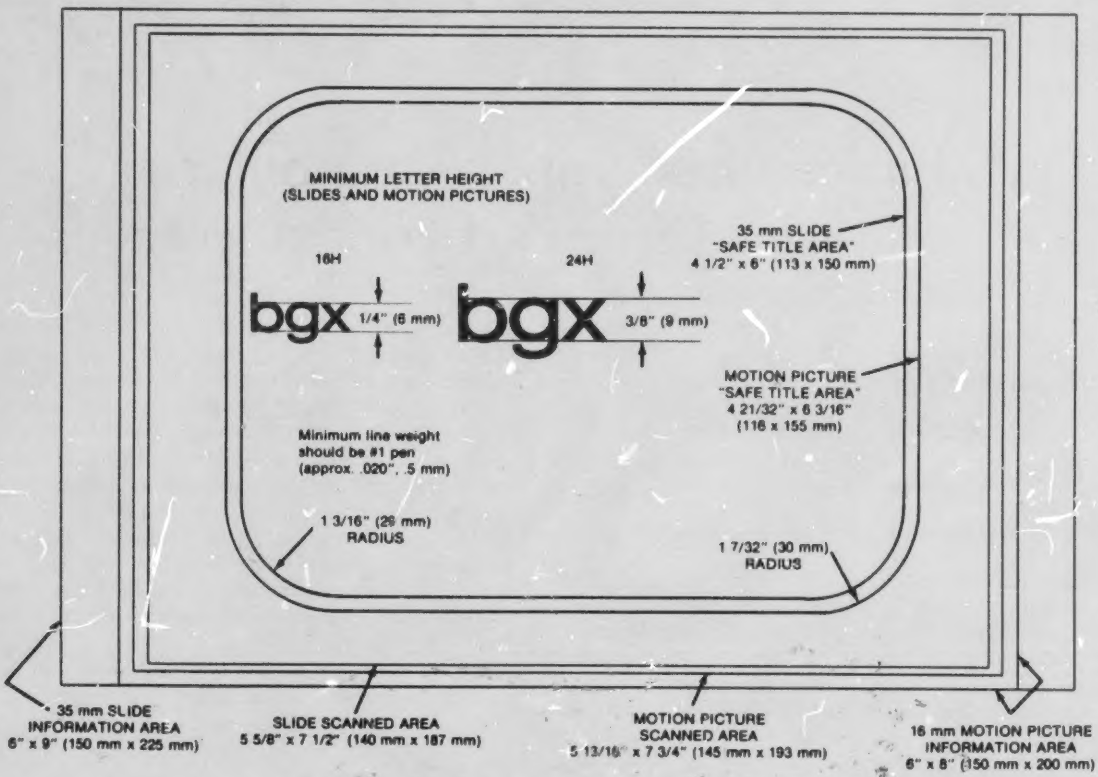

MINIMUM LETTER HEIGHT
(SLIDES AND MOTION PICTURES)
16H
24H
bgx
1/4" (6 mm)
bgx
3/8" (9 mm)
35 mm SLIDE
"SAFE TITLE AREA"
4 1/2" x 6" (113 x 150 mm)
MOTION PICTURE
"SAFE TITLE AREA"
4 21/32" x 6 3/16"
(116 x 155 mm)
Minimum line weight
should be #1 pen
(approx. .020", .5 mm)
1 3/16" (29 mm)
RADIUS
1 7/32" (30 mm)
RADIUS
35 mm SLIDE
INFORMATION AREA
6" x 9" (150 mm x 225 mm)
SLIDE SCANNED AREA
5 5/8" x 7 1/2" (140 mm x 187 mm)
MOTION PICTURE
SCANNED AREA
5 13/16" x 7 3/4" (145 mm x 193 mm)
16 mm MOTION PICTURE
INFORMATION AREA
6" x 8" (150 mm x 200 mm)

Figure 9. **Dimension of artwork template for television system**

Courtesy of Kodak

complex, reduce the information to the essential elements, limit the text and enlarge the letter size. Rearranging the information can help define the point you are making for the audience.

It is a mistake to believe that enlarging the physical dimensions of a transparency improves legibility at practical viewing distances. Transparency size is not a determining factor; it is the size of the detail on the screen that is significant (see figure 10). If letters are to be legible at an 8H viewing distance of 32 ft, a projected image 1 in. (25 mm) high on the screen is required whether projection is from a 2 X 2 in. (50 X 50 mm) slide or a 10 in. (250 mm) wide transparency on an overhead projector, regardless of the overall projected image size.

Standardization

Layout and preparation

A minimum size for lettering has been established to meet legibility requirements, but legibility is not the only requirement for effective communication; flexibility to allow emphasis and pleasing design are also important. However, it will be wise to use at least three sizes of letters to provide proper treatment and a variety of titles—primary, secondary and tertiary. The use of more than three sizes, all larger than the recommended minimum, allows even greater variety in artistic expression. Of course, standardization of letter sizes is practical only when the format and overall size of the artwork are also standardized.

Advantages

The cost of skilled professionals such as artists and photographers, if available, far outweighs the cost of materials. Therefore, the largest savings in preparing a visual presentation can be achieved by reducing the time required to complete it. The standardization of format and size of artwork will mean the greatest reduction in costs. Standardization brings other benefits. The artist can work with a few standard, readily available pens, brushes, guides, and sizes of type and quickly develop a feel for the size of lettering and artwork elements that will produce legibility. Therefore, standard-size artwork becomes easier and faster to prepare than the alternative—an assortment of sizes and shapes. Standard sizes simplify the stocking of mounting boards and paper stock. Making the artist's and photographer's jobs less time-consuming can increase productivity without increasing cost.

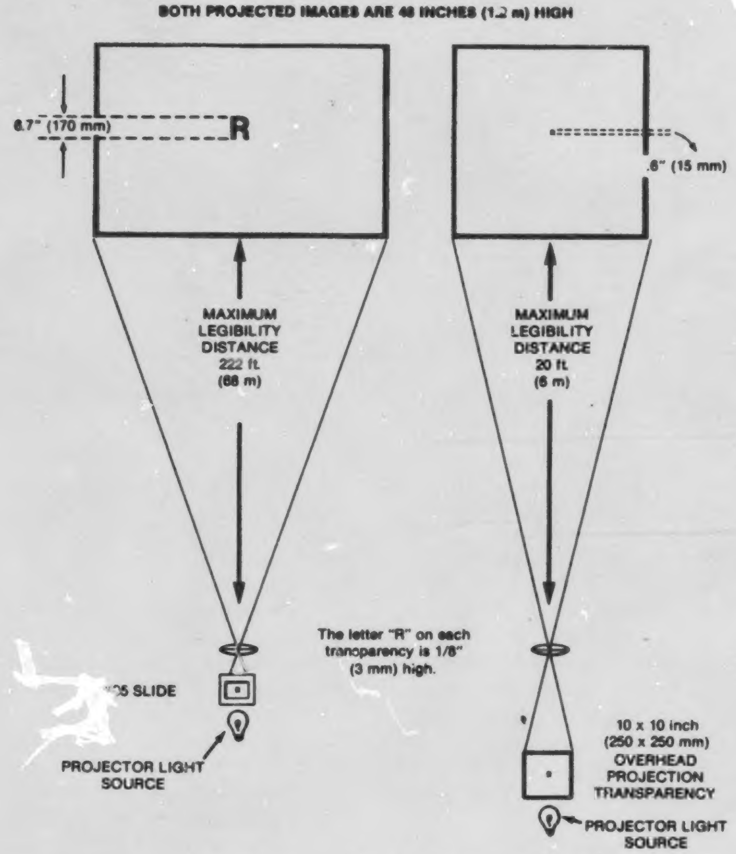

BOTH PROJECTED IMAGES ARE 48 INCHES (1.2 m) HIGH
6.7" (170 mm)
R
.6" (15 mm)
MAXIMUM LEGIBILITY DISTANCE 222 ft. (68 m)
MAXIMUM LEGIBILITY DISTANCE 20 ft. (6 m)
35 SLIDE
PROJECTOR LIGHT SOURCE
The letter "R" on each tranoparency is 1/8" (3 mm) high.
10 x 10 inch (250 x 250 mm) OVERHEAD PROJECTION TRANSPARENCY
PROJECTOR LIGHT SOURCE

Figure 10. Comparison of legibility distance

Courtesy of Kodak

A standard field size for artwork and a specified location for the working area on the artwork can speed the photography and consequently increase the photographer's output. When working with artwork of random sizes and formats, the photographer must repeatedly adjust the distance of the camera to the artwork, the focus and the exposure settings. Conversely, the photographer will be able to set lights, camera distance, focus, and exposure only once for each complete assignment rather than once for each individual piece of artwork if the following conditions are met:

(a) The artwork is all the same size;

(b) The working area of the artwork is of the same dimensions on every piece of art;

(c) The working area is in an identical location on each piece of art;

(d) Provision is made for placing each piece of artwork in the same position on the copy stand.

With respect to storage and retrieval, adopting a uniform 10 X 12 in. (250 X 300 mm) artwork size offers savings in cost and time. Storage of this size requires no expensive equipment of odd dimensions; letter-size office filing cabinets or desk drawers will serve. Artwork can be stored on edge and segregated into categories with standard separators. The material is readily accessible; the possibility of damage or loss is reduced.

Artwork size and format

A single standard size can be specified for most artwork. If a larger or smaller piece of artwork has to be produced, a different working area of "field size" will be needed. For example, if an existing drawing is to be used in a piece of art and it is loo large to fit into the standard 6 X 9 in. (150 X 225 m) working area, a larger working area should be selected having the same height-to-width ratio as indicated in the format chart. The lettering will also have to be enlarged to meet the 1/50 rule. For example, if the working area is enlarged to 8 X 12 in. (200 X 300 mm), the letter size should be a minimum of 5/32 (4 mm) of an inch. For more unusual enlargements the legibility calculator shown in figures 15 and 16 should be consulted.

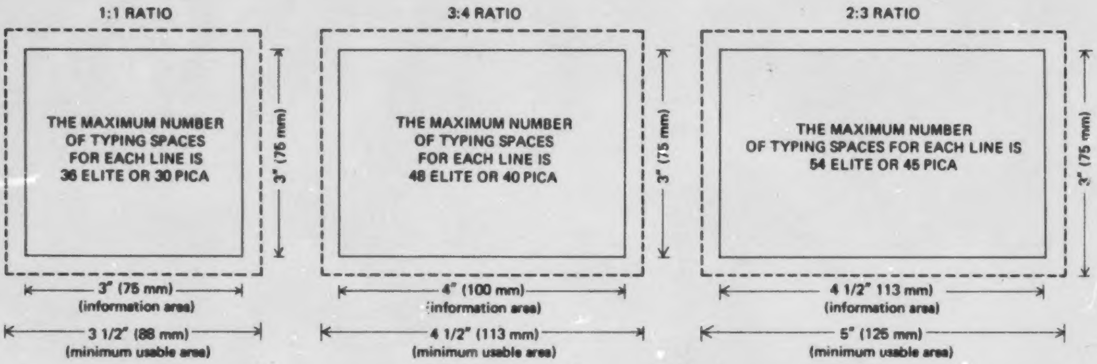

1:1 RATIO
THE MAXIMUM NUMBER OF TYPING SPACES FOR EACH LINE IS 36 ELITE OR 30 PICA
3" (75 mm)
3" (75 mm) (information area)
3 1/2" (88 mm) (minimum usable area)
3:4 RATIO
THE MAXIMUM NUMBER OF TYPING SPACES FOR EACH LINE IS 48 ELITE OR 40 PICA
3" (75 mm)
4" (100 mm) (information area)
4 1/2" (113 mm) (minimum usable area)
2:3 RATIO
THE MAXIMUM NUMBER OF TYPING SPACES FOR EACH LINE IS 54 ELITE OR 45 PICA
3" (75 mm)
4 1/2" 113 mm) (information area)
5" (125 mm) (minimum usable area)

Figure 11. Maximum size of information area for typewritten copy

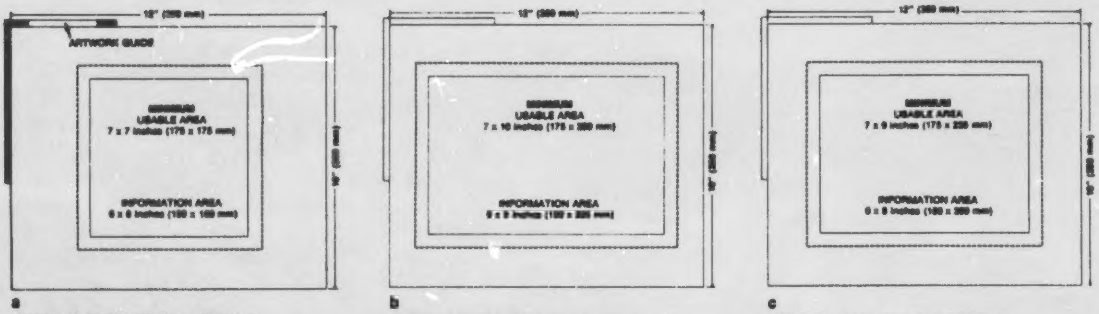
Courtesy of Kodak

The recommended primary standard for the artwork is 10 X 12 in. (250 X 300 mm). The working area sizes suggested in this manual and the formats suggested for typewritten copy (figure 11) will fit this size mount. It accepts the common 8 X 10 in. (200 X 300 mm) photographic print. The mount allows a margin outside the suggested working area to provide for safe handling, pin registration holes or field marks for camera alignment, production notations, and attachment of acetate cells or other types of overlays.

The usable area of the artwork, including the background, must fill a space somewhat larger than the information areas, if background edges are not to show when the visual is photographed. It is good practice to extend the usable area at least ½ in. (13 mm) beyond the information area on all sides. A better practice is to extend the usable area 1 in. (25 mm) beyond the information area.

Construction and use of the artwork template

To prepare the template, which will be used for each format, start with a 10 X 12 in. (250 X 300 mm) piece of light-weight card stock or heavy paper. Keeping the area centred within this card stock, mark off the dimensions of the section to be removed for the particular format that will be used, i.e. 6 X 9 in. (150 X 225 mm) for 35mm slides. If artwork for more than one format is to be created, it is a good time to make a template for each one. To align the artwork in the proper position for photography consistently, construct an L-shaped guide against which the artwork can be placed (see figure 12 a, b and c). If these recommendations as to format and size are adopted, it is necessary to observe only one minimum size requirement; for legibility of letters and of any significant artwork detail at 8H viewing distance, the letter or detail within the


12" (300 mm)
ARTWORK GUIDE
MINIMUM USABLE AREA 7 x 7 inches (175 x 175 mm)
INFORMATION AREA 6 x 6 inches (150 x 150 mm)
10" (250 mm)
12" (300 mm)
MINIMUM USABLE AREA 7 x 10 inches (175 x 250 mm)
INFORMATION AREA 6 x 9 inches (150 x 225 mm)
10" (250 mm)
12" (300 mm)
MINIMUM USABLE AREA 7 x 9 inches (175 x 225 mm)
INFORMATION AREA 6 x 8 inches (150 x 200 mm)
10" (250 mm)

a
ARTWORK TEMPLATE FOR A FORMAT WITH A HEIGHT/WIDTH RATIO OF 1:1

b
ARTWORK TEMPLATE FOR A FORMAT WITH A HEIGHT/WIDTH RATIO OF 2:3

c
ARTWORK TEMPLATE FOR A FORMAT WITH A HEIGHT/WIDTH RATIO OF 3:4

Figure 12. Artwork templates for three formats

Courtesy of Kodak

format area should have a minimum size of 1/50 of the information area.

Typical materials for the three formats are:

Figure 12 a (height/width ratio 1 : 1)–2 X 2 slides with a square mask opening (26.5 mm, 30 mm, 38 mm etc.); and 2¾ in. square slides for 2¼ in. square transparencies;

Figure 12 b (height/width ratio 2 : 3)–2 X 2 slides in a horizontal format made with a conventional camera, using 35mm film (22.9 X 34.2 mm mask opening);

Figure 12 c (height/width ratio 3 : 4)–motion pictures (Super 8mm, 8mm, 16mm); size 110 slides (30 X 30 mm outside dimension and a 12 X 15.8 mm mask opening).

Size of letters, symbols and lines

Letter size of lower-case characters is specified as the height of the letter excluding ascenders or descenders (the "tails" on p's, q's, b's etc.). When determining letter size or specifying it for artwork, measure the smallest letter to be used. Since the artwork height in figure 14 is 6 in., letter height for 4H viewing is 1/16 in. (1.5 mm), for 8H viewing 1/8 in. (3 mm), and for 16H viewing ¼ in. (6 mm) (see figure 11).

The specified minimum size should not be construed as a restriction on the use of larger sizes. Bolder or bigger treatment is often advantageous, e.g. to increase emphasis and strengthen impact.

When printer's type is being considered or specified, characters on a printed proof should be

8 POINT

Printing has performed a role of achievement unparalleled in the revelation
PRINTING HAS PERFORMED A ROLE OF ACHIEVEMENT UNPARALLELED
Printing has performed a role of achievement unparalleled in the revelation
PRINTING HAS PERFORMED A ROLE OF ACHIEVEMENT UNPARALLELED
Printing has performed a role of achievement unparalleled in the revelation
PRINTING HAS PERFORMED A ROLE OF ACHIEVEMENT UNPARALLELED

16 POINT

Printing has performed a role of achiev
PRINTING HAS PERFORMED A ROLE
Printing has performed a role of achiev
PRINTING HAS PERFORMED A ROLE
Printing has performed a role of achiev
PRINTING HAS PERFORMED A ROLE

24 POINT

Printing has performed a
PRINTING HAS PERFOR
Printing has performed a
PRINTING HAS PERFOR
Printing has performed a
PRINTING HAS PERFOR

Figure 13. Different point sizes of lettering types

Courtesy of Kodak

measured. Point sizes can be misleading; 18-point type may be suitable for capital-letter copy, but the same copy in lower case can require the use of 24-point type. Typefaces also vary; 9 point may be suitable in one style, but not in another. Different point sizes of one type style are shown in figure 13.

Dry-transfer lettering systems (Deca-Dry, Letraset, Prestype etc.) are sheets of letters that can be transferred to the artwork by burnishing. A wide selection of type styles is now available all over the world in different point sizes, and most art supply stores have catalogues showing the letters in actual size.

Legibility of typewritten copy

A typewriter offers one of the simplest and quickest means of producing legible copy. All that is required is the use of a smaller information area and close-up photography to include only this area. If the artwork information area to be used is 3 in. (75 mm) high and the legibility requirement is for 8H viewing, élite type in all capital letters is the smallest acceptable size. It is recommended that typewritten copy be restricted to the information areas shown in figure 11. As with other types of artwork, the minimum usable area should extend somewhat beyond the information area. With typewritten material a minimum usable area of at least an additional ¼ in. (6 mm) (shown with dotted lines in figure 11) on all four sides can be obtained by simply including more of the paper on which the message is typed. The 3 in. (75 mm) height provides 8H legibility for all copy from standard typewriters, including élite and pica type, yet it offers a large enough area for direct artwork for simple charts, graphs and diagrams. For the 3 in. (75 mm) high format, copy should be limited to nine double-spaced lines.

Long-distance viewing (large H factors)

Material for small rear-projection cabinets, used in exhibits or points of sale, often is viewed from greater than normal distances. For applications of this type, a projected image as small as 8 in. (200 mm) in height may need to be readable at distances up to 20 or 25 ft (6 or 7.5 m), approximately 30H. The size of lettering may have to be enlarged proportionally. In such a case, lettering should be at least four times larger than the minimum for 8H viewing. For an artwork information area 6 in. (150 mm) high, the minimum letter height should be ½ in. (13 mm). Remember, however, that rear-projection cabinets used in study carrels may be viewed at a distance of only two or three times the screen height and that artwork for these situations can be sized to 2H or 3H requirements.

Television

Television images are frequently viewed at distances greater than 8H. For example, an image only 12½ in. (315 mm) high on a 21 in. (533 mm) picture tube may often be viewed from 20-30 ft. (7-9 m) in the home or in a class-room. Therefore, when material is being prepared for such use, legibility requirements for comparatively great viewing distances must be considered, as shown in figure 9.

In addition, some area of the original transparency will be lost in the television chain and in the receiver. Figure 14 illustrates the 6 X 9 in. (150 X 225 mm) artwork area of a 35mm slide with a safe title area mask for television placed over it. The figure shows how much visual area (shaded portion) may be lost in the television system. The amount lost is not always the same; it varies with such things as receiver adjustment and line voltage. To help provide minimum loss, any essential information must be confined to a central area, as indicated in this figure. Even so, the usable portion of the artwork should extend to a minimum area of 7 X 10 in. (175 X 250 mm). Minimum letter height (lower-case character less ascender or descender) can be 1/4-3/8 in, (6-9 mm) as shown in figure 11. These letter heights allow 16H-24H viewing and provide legibility at distances of 18-24 ft (5.5-7.3 m), 21-27 ft (6.4-8.2 m), and 23-30 ft (7-9.1 m), respectively, from a 17, 21 or 25 in. (432, 533 or 635 mm) picture tube.

Where possible, it is recommended that the finished artwork be reviewed both in colour and black-and-white on the telecine chain before being broadcast. This procedure will indicate any changes in the artwork (contrast, separation of tones, letter height and colour) needed to make it acceptable for broadcasting. If it is not practical, the artwork must be created to take these elements (of the artwork) into account. One colour that reflects or transmits the same amount of light as another colour will cause the two colours to appear as the same neutral tone on a black-and-white television receiver.

If the artwork is to be used for both TV transmission and regular projection, the lettering and title area should be designed to meet the TV requirements. When the material is being photographed for a projection slide, an extreme close-up can be made so that unnecessary background will be eliminated.

Legibility calculator

The calculator (figures 15 and 16) is designed to help provide legibility of slides for the oft-forgotten man in the last row. It is based on the average legibility requirements and on standardized artwork sizes as explained earlier.

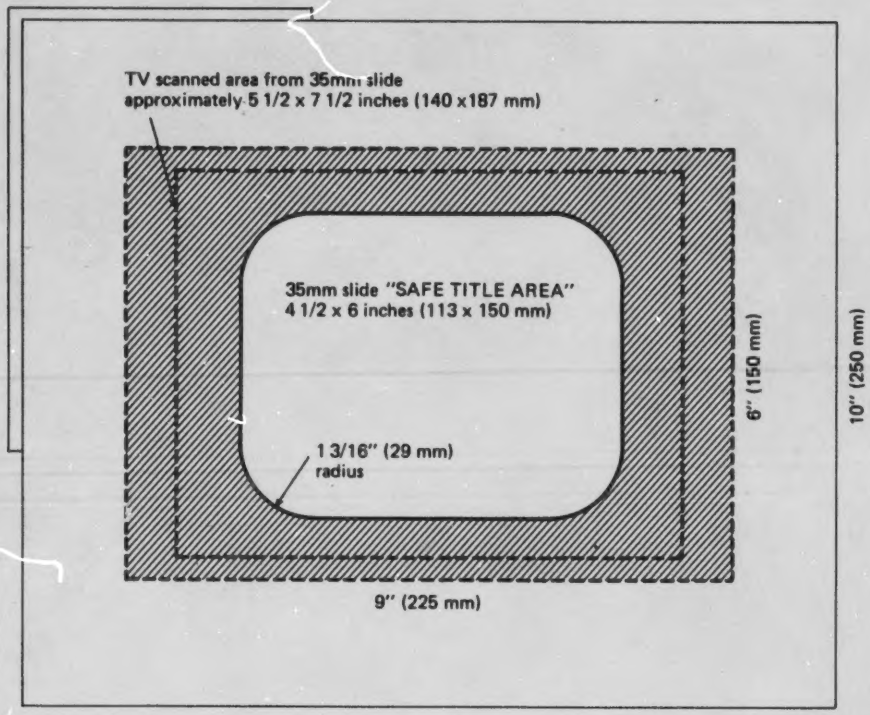

TV scanned area from 35mm slide
approximately 5 1/2 x 7 1/2 inches (140 x 187 mm)
35mm slide "SAFE TITLE AREA"
4 1/2 x 6 inches (113 x 150 mm)
1 3/16" (29 mm)
radius
6" (150 mm)
10" (250 mm)
9" (225 mm)

Figure 14. Area for titles for 35mm slide projection

Courtesy of Kodak

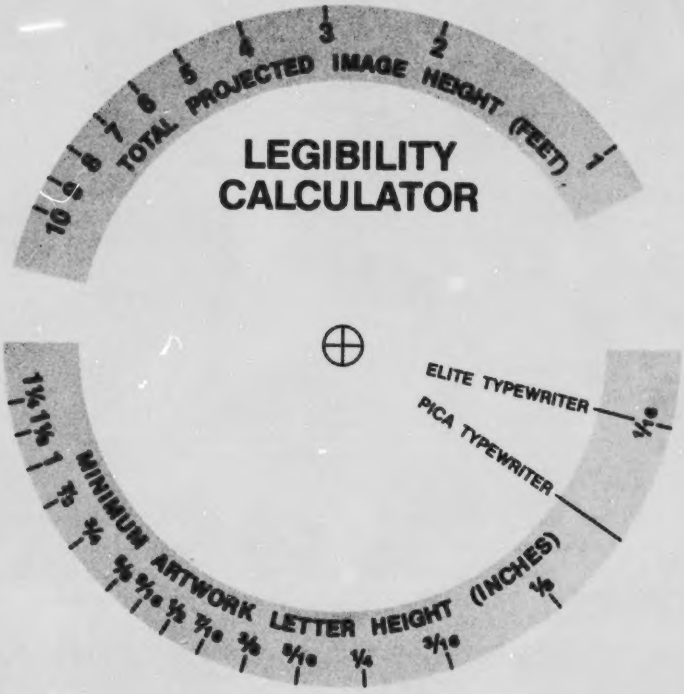

LEGIBILITY
CALCULATOR
TOTAL PROJECTED IMAGE HEIGHT (FEET)
10
9
8
7
6
5
4
3
2
1
MINIMUM ARTWORK LETTER HEIGHT (INCHES)
1¼
1⅛
1
7/8
3/4
5/8
9/16
1/2
7/16
3/8
5/16
1/4
3/16
1/8
1/16
ELITE TYPEWRITER
PICA TYPEWRITER

Figure 15. Legibility calculator

Courtesy of Kodak

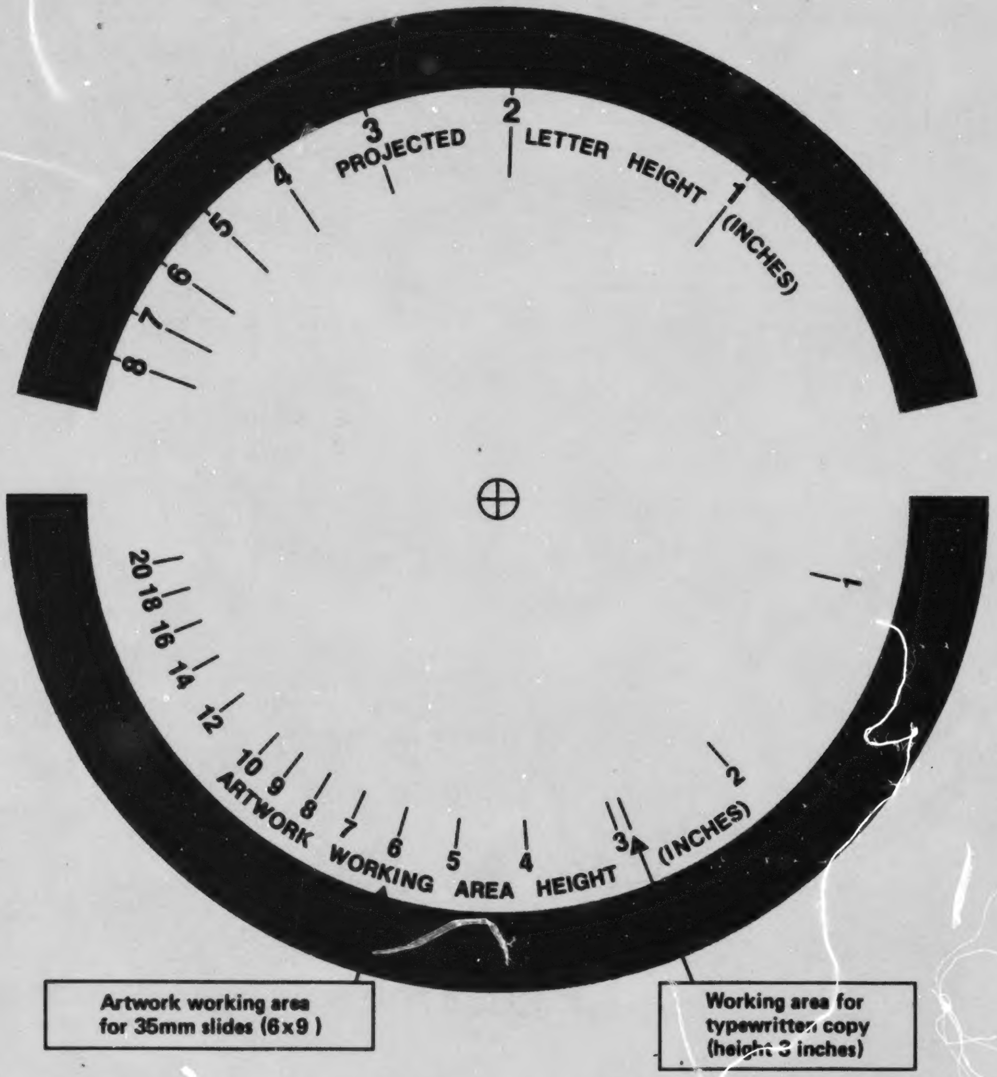

PROJECTED LETTER HEIGHT (INCHES)
8
7
6
5
4
3
2
1
ARTWORK WORKING AREA HEIGHT (INCHES)
20
18
16
14
12
10
9
8
7
6
5
4
3
2
1
Artwork working area for 35mm slides (6x9)
Working area for typewritten copy (height 3 inches)

Figure 16. Artwork working area

Courtesy of Kodak

The calculator can easily be assembled by making photocopies of figures 15 and 16, and cementing and dry-mounting on to card stock before trimming. (A manila file folder is an example of suitable card stock.) Use care to trim the dial (figure 15) accurately and be sure the centres are aligned perfectly before you secure the dial to the base (figure 16).

The calculator is a useful tool in determining the minimum artwork letter size that will be legible for the entire audience. Or, the calculator can help to determine the proper screen size or farthest acceptable viewing distance when slides must be produced from existing artwork. For example, if you have a 6 X 9 in. working area and wish to fill a 4 ft high screen that will be viewed from 64 ft—the distance from the screen to the last row in the auditorium—set a "total projected image height" of 4 ft at the 64 ft mark on the "distance-of-farthest-viewer" scale. You will notice that the "minimum artwork letter height" that lines up with 6 inches on the "artwork-working-area height" scale is ¼ in. If both capitals and lower-case letters are being used, the minimum height of the main body of the lower-case letters will therefore have to be at least ¼ inch to be legible from the last row, as shown in figure 17.

Another use of the calculator is to determine acceptable screen height when you are required to use existing art. Assume you have a 6 X 9 in. (150 X 225 mm) piece of artwork on which the height of the lettering is only 1/8 inch (3 mm). Set the 1/8 in. mark at the 6 in. mark on the lower scale. Note that a screen image 8 ft high would be required for proper legibility from the last row of this same auditorium. Or, using a 4 ft high screen, the farthest viewing distance would have to be limited to 32 ft (10 m), as shown on the "distance-of-farthest-viewer" scale.

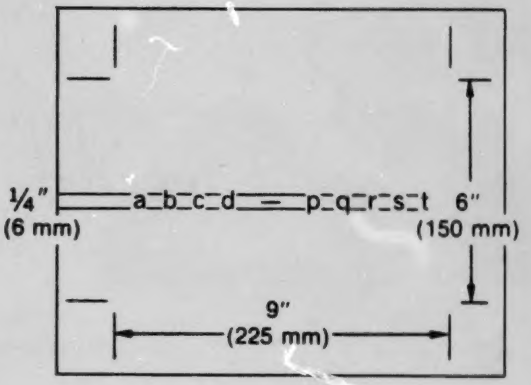


Figure 17. Calculator for minimum artwork letter height

Courtesy of Kodak

V. Non-projected aids

Storyboard

Regardless of the method chosen for a particular presentation or whether non-projected or projected aids are to be used, a considerable amount of planning is necessary. The best way to ensure a well-planned presentation is to prepare a visual storyboard. Such a storyboard should collate both the visual information and the verbal content of a lecture. The storyboard is primarily a planning device for the lecturer to co-ordinate all relevant factors for the lecture. The format can be quite simple. The illustrations can be drawn at the left-hand side of a small sheet of paper or card, and the relevant text can be written or typed opposite or below (see figure 18). The advantages of preparing a storyboard are that it provides the lecturer with the best possible way to prearrange a subject, and it also enables him to change the visuals and his text until he is entirely satisfied with both.

A more advanced form of the storyboard is the planning board.

Planning board

The planning board has many practical applications and is a very helpful device at all stages of organizing a presentation. It is relatively simple to fabricate and can be made from readily available materials. The materials and dimensions specified can, of course, be modified to suit individual requirements. For a lengthy presentation, several boards may be needed; a modest production usually requires only one (see figure 19).

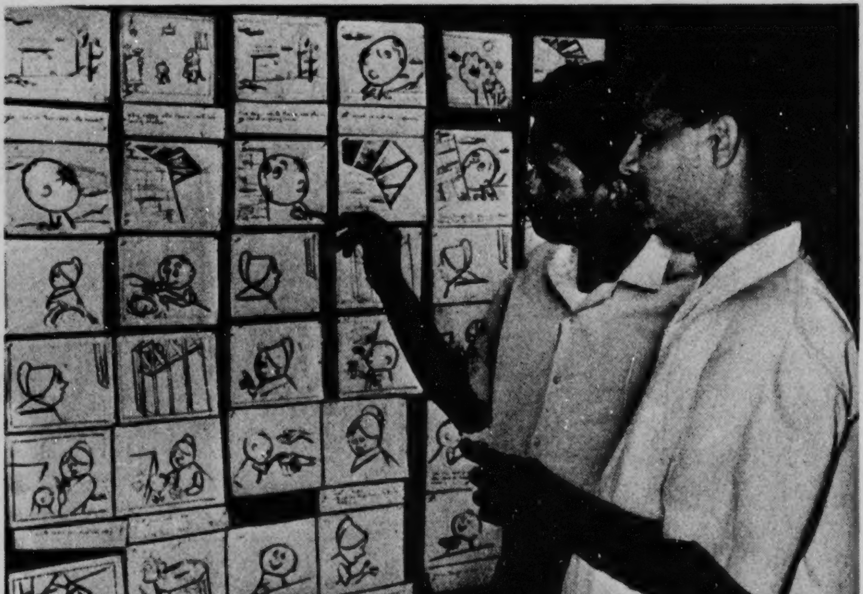


Figure 18. The storyboard

Courtesy of Films Division, Government of India

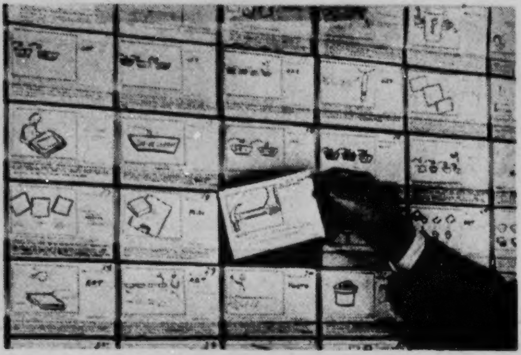


Figure 19. The planning board

Courtesy of Kodak

Advantages and disadvantages

The planning board can be used advantageously in:

- Generating, collecting, and organizing ideas and visuals
- Planning and producing lessons with slide sets, filmstrips and informational films
- Pretesting programmes before production begins
- Communicating assignments to writers, photographers and artists
- Co-ordinating production steps
- Creating integrated visuals and narration
- Preventing waste motion
- Preparing scripts or presentation outlines
- Providing the daily status of a project for checking

It has certain disadvantages:

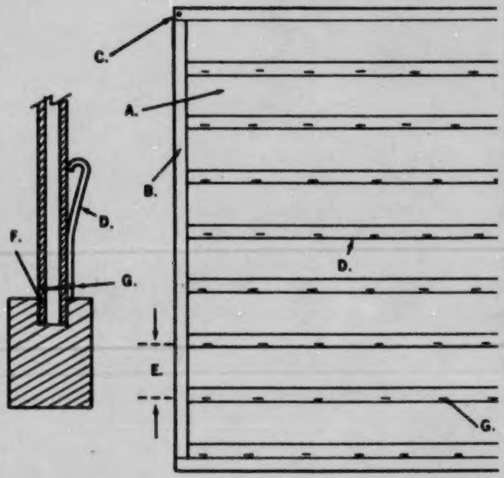
(a) It does not provide movement as in films;

(b) It cannot be seen from long distances;

(c) It works only if the lecturer has skill as a visualizer and writer.

Construction

The board is quite simple to make. Essentially, it consists of a piece of ¼ in. (6 mm) plywood set in a frame made of 1 X ¾ in. (25 X 19 mm) pine (see figure 20). Plastic strips are stapled on one or both sides. A board can be painted to give it a finished appearance. Holes can be drilled through the top for hanging, or the board can stand on a display rack or easel. These boards hold 56 cards. The planning card retainer strips (D) are 47 in. (1.19 mm) prefabricated plastic strips that hold the cards in place on the planning board. Each retainer strip must be mounted with the beaded side toward the panel.



A ***Panel:***
¼ inch (6 mm) fir plywood, 48 x 31 7/8 inches (1.22 x 0.81 m)

B. ***Frame:***
1 x ¾ inch (25 x 19 mm) pine, rabbeted ¼ x ¼ inch (6 x 6 mm) to fit panel

C. ***Provision for hanging:***
5/16 inch (8 mm) diameter holes, slightly beveled at both ends to fit over ¼ inch (6 mm) diameter metal pegs or rods; or use screw eyes in the top of the frame

D. ***Card retainers:***
see detail above, and text below this panel

E. ***Retainer spacing:***
4 inches (102 mm), centre to centre for 4 x 6 inch (102 x 152 mm) cards

F. ***Rabbet detail***

G. ***Retainer staple:***
¼ inch (6 mm) gun-type

Figure 20. Planning board construction

Courtesy of Kodak

How to use

Plain white 3 X 5 in. (76 X 127 mm) or 4 X 6 in. (102 X 152 mm) index cards are commonly used in the initial planning stage. Write on each card one idea or point you want to include to achieve the slide or filmstrip objective. Put the first card on the board; write another idea on another card and put it on the board; repeat the process until no more pertinent thoughts come to mind. If more than one person is involved at this step in planning, the brainstorming, or random-thinking, technique is adopted. Every idea that occurs to anyone–no matter how unlikely it may seem at the time–should be written on a card and placed on the board. Often, even a seemingly impracticable suggestion can spark an excellent idea (see figure 19).

Instead of using the planning board, the cards can be laid on a table or the floor. The advantages of the board are that the cards are held quite firmly and not easily dispersed, and the whole board can be carried to another room (for more work or for submission for approval) without disturbing the sequence of ideas.

When sufficient thoughts have been recorded and placed on the board, some editing takes place: cards bearing similar or overlapping points are grouped; ideas that are not suitable for filming or are inconsistent with the objective are set to one side but not discarded—there may be reason to refer to them later. If new possibilities occur during this editing, they are written on cards and added to the board. Finally, the cards are arranged to represent the continuity of the ideas in the completed film, if indeed a film is required at all. When the planner is satisfied with the result, it is presented to the proper authority for approval. It may also be a good idea to photograph the board at this time for future reference, in the event that the composition is changed.

After the plan as represented by the ideas on the planning board has been approved, the next step is to visualize in detail the points written on the previously mentioned plain white cards. At this stage the lecturer may decide that he is through with the planning board and could turn to a storyboard. Instead of plain white cards, specially prepared 3 X 5 in. (76 X 127 mm) or 4 X 6 in. (102 X 152 mm) cards may be used. These cards can easily be composed, then duplicated in quantity on almost any office copier.

Chalkboard

The chalkboard consists of a painted wooden plate (often black) on which a lecturer can write using either white or coloured chalk. It can be supported by fixing the board to the wall in a lecture hall or placing it on an easel if the lecture is to take place out of doors.

Advantages and disadvantages

The chalkboard has several advantages:

(a) It needs no elaborate preparation and set up such as a darkened room or electrical equipment. It can also be used in the open air;

(b) It is comparatively inexpensive;

(c) It is long-lasting and easy to keep up;

(d) The demonstrator can use it instantly;

(e) It permits the learner to participate actively in the demonstration;

(f) Mistakes can be corrected easily;

(g) The demonstrator is able to adapt his material to the skill and intelligence of his audience.

The disadvantages are:

(a) The chalkboard does not provide movement as film does;

(b) The diagram drawn on the board needs careful preparation as part of the lecture;

(c) Its value depends on the writing and drawing skill of the lecturer;

(d) It is difficult to keep clean.

Advice on use

If a chalkboard is to be used, the lecture notes should be prepared beforehand and the sections that could be demonstrated visually on the board marked with as much clarity as possible. The guidelines for what can be shown on the board visually and what can be put across verbally should depend on the content of the subject, the intelligence of the audience and your skill.

Sometimes it is advantageous to draw a statement or diagram on the board before a demonstration starts. Then with the text and the material that has been previously prepared, the lecturer can build up a statement step by step, carefully controlling the timing and the pace of presentation according to the learner's capacity. The learner should be involved in the presentation as much as possible. An active response can be achieved, for example, if some of the words or symbols are drawn by the learners before or during the lecture. Self-instruction may be most effective once the learner is sufficiently motivated to study by himself even if he is not technically perfect.

Some proficiency in craftsmanship is essential even in the handling of a chalkboard. It is an asset to be able to draw and write on the board efficiently and in rhythm with the spoken words. With such synchronization the chalkboard can be one of the most efficient tools to put across the instruction quickly.

A few hints may be offered:

(a) Do not turn your back on your audience when speaking and writing or drawing on the board;

(b) Be quick with your visuals;

(c) Make the pictures clearly visible to everyone in the audience;

(d) Make the words clear and legible (which may mean rehearsing beforehand);

(e) Use thick, clear and bold lines;

(f) Always have a cloth available to erase corrections;

(g) Always have extra chalk ready;

(h) Choose colours carefully; the right choice can add emphasis.

Markerboard

Unlike the chalkboard, the surface of the markerboard is white. For this reason it is often called the "whiteboard". Its development was made possible by the introduction of felt-tip pens in recent years. It is especially useful when cleanliness is required. The board is usually made of white plastic on which the images are applied with felt-tip colour markers. Multicolour writing and drawings on a white surface may be of some importance in laboratories and in situations where it is useful to reproduce symbols in colour codes and where a dustless atmosphere is required.

Advantages and disadvantages

The advantages of using the markerboard are:

(a) No chalk dust is produced;

(b) It can be kept the cleanest of all boards;

(c) Several colours can be applied;

(d) The board can serve as a projection screen;

(e) It can be the basis of strong graphic images;

(f) Mistakes can be wiped out easily;

(g) It can be used in the open air.

The disadvantages are:

(a) The markerboard does not provide motion;

(b) The drawings and writings require careful preparation;

(c) Reflection can be a problem with strong sunlight; the solution is to use matt surfaces;

(d) A damp cloth is required to wipe off corrections. The board must be dry before it can be used again. It may take slightly longer to dry than the chalkboard;

(e) The colour markers must be of the right type, i.e. water-based. If they are spirit-based they easily leave unwanted marks on the board; which must be washed off with a domestic bleach or special liquid removers manufactured by the markerboard suppliers.

Advice on use

When any one of these boards is being used, the presentation should be well prepared. Since bright colours can be used with the markerboard, this feature should be taken advantage of. If you have the skill and the craftsmanship, you should write and draw from notes instantaneously in front of the class, since certain points can be emphasized and clarified through multicolour writing and drawing.

Since the visuals appear more defined on the whiteboard than on the blackboard, the layout should be more carefully considered. The appearance of the visuals is clearer and more professional looking; hence, both the lecturer and the students prefer the markerboard.

However, you must accustom yourself to using a marker differing from chalk. Instead of holding it upwards as if it were chalk, you should hold the felt-tip marker downwards as if it were a regular pen. The coloured ink flows from the pen with far less resistance on the smooth plastic surface than chalk against a wood surface.

A few hints may be offered:

(a) Do not turn your back to your audience while writing or drawing;

(b) Work out the time-table when using the markers;

(c) It is useful to have some points already drawn on the board at the start of the lecture, but avoid finishing the visuals too quickly. You must allow the audience enough time to digest the lecture and to make notes;

(d) Work out the layout of the visuals beforehand, and make sure that both writing and drawing are clearly visible even from the back of the class;

(e) Make functional use of colours, but do not use colours for their own sake;

(f) Always have a cleaning kit available to erase and to correct.

It is an advantage to be able to draw and prepare such graphic pictures as symbols, diagrams, images and lettering.

Flipboard

The flipboard consists of 10-20 large sheets of drawing paper attached by screws or clips to a stable backing. The sheets are drawn or written on with spirit markers, crayons etc. during the course of a lecture or demonstration; or, alternatively, sheets prepared in advance may be mounted in the required order of exposition. When no longer required, each sheet may be folded (or flipped) back over the board to reveal the next sheet, calendar fashion. Flipboards and easels are commercially available, but can also be constructed simply to your own specifications.

Advantages and disadvantages

The advantages of using the flipboard are:

(a) It saves time when a lecture must be repeated several times;

(b) It is relatively cheap and easy to transport;

(c) It is dust-free in use;

(d) It offers flexibility–professionally finished diagrams or your own drawings can be shown;

(e) The concentration of the audience is focused only on the diagram being shown at the moment, not on the preceding material;

(f) Points made during a lecture can be quickly and easily reviewed in summing up its content;

(g) Visuals can be prepared in advance.

The disadvantages are:

(a) Considerations of size limit the use of the flipboard to small conference or class-rooms;

(b) It is normally necessary to turn one's back to the audience when writing;

(c) Spirit markers will often seep through to underlying sheets unless paper with a non-porous coating is used;

(d) Use in the open air is not recommended.

Advice on use

Make your letters and drawings as large and bold as possible—writing should be at least 1 in. high. Prepare as many as possible beforehand. Do not overfill each sheet. By lightly pencilling in the material you intend to draw in advance of your lecture, you will not only have an excellent aid to your memory, invisible to your audience, but your lecture will gain in fluency and assurance. Avoid using paper with a very shiny surface, since it will cause disturbing reflections.

Flannelboard

When two pieces of rough-textured cloth are placed together, they tend to adhere. This principle has been used in the flannelboard. A rough material is stretched over a hard backing, and other pieces of material, cut to a desired shape, are placed upon it to form a diagram. These pieces of material can be written or drawn upon at will. If the underlay is rough enough, not only other pieces of cloth but also paper and similar light materials will adhere almost equally well.

Advantages and disadvantages

The advantages of using the flannelboard are:

(a) The base cloth can be removed and rolled up, so that the flannelboard, together with the diagram elements, can be easily transported from place to place;

(b) It is inexpensive;

(c) With some imagination, almost unlimited graphic effects can be achieved because of the wide variety of cloths available;

(d) The same elements can be used repeatedly;

(e) The lecturer does not need to turn his back to his audience in order to place new elements on the board.

The disadvantages are:

(a) The flannelboard is suitable for small audiences only, since symbols placed on the board are difficult to distinguish at distances much over 15 ft (4.6 m);

(b) The weight of larger elements can sometimes cause them to slip; to counteract this tendency, the board can be inclined backwards a few degrees from the vertical.

Advice on use

At a maximum viewing distance of 15 ft, symbols or letters should not be smaller than 1 in. (2.54 cm). The adhesive elements should wherever possible be in colours offering maximum contrast to the board itself. Special papers are available in various colours designed to adhere to flannelboards. If you wish to use printed paper matter that does not adhere to the board easily, special paper may be glued to the back of it (sandpaper will also work). It is a good idea to make up a folder containing the elements of a lecture in the order in which they will be required and to number the back of each element accordingly. For the sake of order, each element removed from the board should be put back in its folder; an untidy heap after a lecture is sometimes very difficult to sort out.

Magnetboard

The magnetboard is a board of some ferrous material to which small magnets are glued to the backs of the elements to be displayed. A distinction should be made between the magnetboard and the less well-known magnetic boards; the latter are themselves magnetic, and as a consequence will retain small ferrous metal objects placed on them.

Advantages and disadvantages

The advantages of using the magnetboard are:

(a) It is an ideal aid in planning or designing where frequent changes are necessary, e.g. interior decoration, circuit diagrams, seating arrangements at conferences or banquets;

(b) Subject to the strength of the magnets used, even three-dimensional objects can be stuck to the board (e.g. small models of plant machinery);

(c) The board may be painted to provide any permanent background required;

(d) The backgrounds may be varied by placing paper sheets over the board on which the new

background has been drawn. If the paper is not too thick, the magnetic elements will continue to adhere to the board (see the section on flipboards);

(e) If the magnetboard is painted matt black, it can serve as a combined blackboard and magnetboard;

(f) If not too many sheets of paper are involved, flipcharts can be used in combination with the magnetboard to increase its versatility.

The disadvantages are:

(a) Magnetboards and their associated materials are heavy, bulky and difficult to transport;

(b) When moving the magnetic elements, care must be taken not to scratch the surface of the board.

Advice on use

Make sure in advance that any elements you have prepared do, in fact, adhere to the board. If they do not because they are too heavy, attach additional magnets. This is particularly important if you intend to use several layers of paper over the board. When not in use, magnets should be left adhering to the board so that they do not lose their magnetism – the board acts as a "keeper". Many modern conference rooms have steel strips underneath the plaster of the walls; these are specially designed for magnetboard applications. Magnetboards are ideally suited for the production of titles and other pieces of text for slides and films.

Plastigraph

The plastigraph is similar in application to the flannelboard, except that it operates on the principle that with certain materials smooth surfaces adhere to each other. Sheets of clear celluloid are mounted on a smooth board made of glass, perspex or enamelled metal by pegs at the top of the board. The display elements, which are cut out of coloured plastic foil, are placed on these sheets. A complicated display can be built up element by element so that, thanks to the transparent sheets, the end effect is that of one complete diagram.

Advantages and disadvantages

The advantages of using the plastigraph are:

(a) Like the flannelboard, the plastigraph permits a diagram or similar display to be built up in stages;

(b) The brilliant colours in which the plastic foil is available make a plastigraph display easy to see and eye-catching. When a transparent base is used, this brilliance can be increased by back lighting;

(c) Adhesion is greater; thus the board may be used in draughty situations or out of doors;

(d) The cut-out elements are tough enough to withstand repeated use and can be moved about at will;

(e) The various plastic surfaces can be written on with washable markers during a lecture and later erased. If a metal base is used, magnetic elements can be incorporated in the display.

The disadvantages are:

(a) Unsuitable lighting can cause unwanted reflections on the board;

(b) Plastic foil is considerably more expensive than paper;

(c) The foil's great adhesion sometimes makes the removal of elements difficult;

(d) Dust can interfere with the adhesive properties of the plastic and is difficult to avoid because of the material's tendency to become charged with static electricity;

(e) Displays that are left too long will curl at the edges, particularly in a warm temperature.

Advice on use

As with a flannelboard, the prepared sheets and elements should be kept flat in a folder in the order in which they are to be presented. If difficulty is encountered in removing elements, a small piece of paper may be glued to the underside edge to afford leverage for the fingers. If static causes trouble, anti-static aerosols are available.

Multiboard

As its name implies, the multiboard combines characteristics of other display boards in one unit. It is, in fact, a flipchart, chalkboard, magnetboard and screen for projected aids all rolled into one, and more modern versions can even be used as a plastigraph.

Advantages and disadvantages

The advantages of using a multiboard are similar to those listed for the individual types of board. Additional advantages are:

(a) It permits flexibility;

(b) Most boards are collapsible and easy to transport;

(c) It is ideally suited for conference rooms and customer demonstrations.

The disadvantages are also similar to those listed for the individual types of board. Additional disadvantages are:

(a) The board's multiplicity of functions can be confusing to those unfamiliar with one or more of its functions;

(b) Some commercially available boards are too heavy for ease of transport;

(c) The over-enthusiastic user of such boards sometimes falls into the error of over-exploiting its potential during a lecture, thereby confusing his audience;

(d) Some combination board manufacturers reduce the size of the display area to save on weight. In this case the boards can be used only in small auditoriums.

Advice on use

Suggestions for using the individual board types are applicable.

VI. Voice production

This chapter deals with sound alone, divorced as far as possible from any consideration of visual aids. It should be remembered, however, that many of the remarks made about the applications of equipment for reproduction of sound apply equally well to audio visual equipment, as will perhaps be better understood if it is borne in mind that a sound projector is essentially a film projector into which the equivalent of a tape recorder has been built, and that neither a tape recorder nor a sound projector can compete with a pneumatic drill in the near vicinity!

For the purposes of this manual, sound can be most simply defined as air-borne vibrations that make their presence known to us through our ears, i.e. our sense of hearing. Any object vibrating at a frequency within the human range of hearing will normally impart its vibrations to the air, and the air will vibrate in sympathy with it. The sound-waves thus produced will set up vibrations in the human ear, which then converts them into electrical impulses that are carried to the brain.

The human vocal chords operate on entirely mechanical principles, similar to those of musical wind instruments: air from the lungs is forced past the vocal chords; and depending on the degree to which these are extended or contracted, sounds of varying pitch and loudness issue from the mouth. These sounds are capable of being modulated further through the action of ancillary vocal organs in the mouth–the tongue, palate and lips–to produce the complicated series of sounds known as speech. It is perhaps because we are so familiar with it that this, the human means of communication *par excellence*, is so often neglected. Thus, no apologies are offered for including the human voice here as a piece of audio equipment having a prime place in the field of instruction.

The lecturer or instructor must endeavour to be audible, intelligible and interesting. A professional actor or lecturer has learned how to project his voice in such a way that, without the benefit of an amplifier, he can be heard distinctly even by large audiences. He is aware that the volume of sound he produces is directly in proportion to the amount of breath–or energy–he applies to his vocal apparatus. The ability to do this should not be confused with knowing how to shout; in shouting, the loudness of the voice is certainly increased, but the energy comes from the lungs only; the modifications to the speech organs necessary to maintain conversational intelligibility under the stress of a vastly increased flow of air through them is ignored. Good voice production at increased volume, on the other hand, depends on the ability of the speaker to exert full control over his speech organs under these (for the average person) exceptional conditions. The technique of good public speaking is, like so many other things, acquired simply by an awareness of the problems involved and by constant practice. Having said that, the following simple tips will be of help:

(a) Since your breath is the main source of energy for expressing yourself orally, it follows that you will need more of it in public speaking than in normal conversation: hence, take a really deep breath whenever possible, and try to time your breathing in such a way that an intake of breath coincides with a natural pause in what you are saying. Practise breathing in and out in a quiet, controlled fashion. Few things appear sillier than a speaker who is gasping for breath at the end of a monstrously long sentence for which he has taken insufficient breath, so breathe deeply or use shorter sentences! If you are preparing your own lecture or instructional material, remember that language written for the eye to read does not necessarily sound good to the ear. Short, pithy statements in simple language are preferable to long, involved sentences that sound pompous and artificial;

(b) Direct your voice as far towards the back of your audience as you can. In practice, it simply means keeping your head at a somewhat higher angle than you normally do. At the same time, however, take care that you appear to be addressing your audience as a whole–you do not need to keep your eyes on the last row of listeners as well. A common error is for the lecturer, without realizing it, to be mesmerized by a member of the audience who gives the appearance of being particularly interested in what he has to say, and to address the whole of his lecture to that person. This error may be prompted by nervousness or lack of experience, but will normally be construed as bad manners;

(c) Inexperienced speakers in front of strange audiences often exhibit unusual mannerisms that distract the audience from the subject matter of the lecture; swaying to and fro, spectacle polishing and other so-called displacement activities are to be avoided as far as possible;

(d) Avoid speaking too quickly, particularly if your audience consists of people who are not native speakers of your language. This warning may at first sight appear to be superfluous, but experience shows that a nervous speaker often races through his lecture, possibly in the hope that by doing so he will draw the audience's attention away from any inadequacies in his theme or presentation of it; the reverse is true.

VII. Projected still pictures

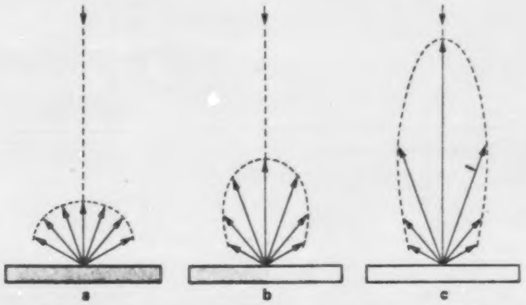
Projection systems

Many types of projection equipment can be used to display small graphic originals of all kinds on a large screen, so that a group of people can see the original graphic, greatly enlarged by optical projection on the screen. The screen size may be selected to suit the size of the room and the number of people viewing. The distance of the projection equipment from the screen will determine the size of the projected image.

Normally, the projection equipment is sited behind the viewers, throwing the projected image on to a screen at the front of the viewers. Pictures shown in this manner, known as front projection, must be presented in a properly darkened room. When circumstances do not permit use of a darkened room, special daylight projection screens may be used. Such screens have a high reflectivity that allows for projection even in a room in full daylight. However, these screens are usually highly directional, so that a bright image will be seen only by viewers in the centre of the room, while those seated towards the edges of the room will see an image greatly reduced in brilliance (see figure 21). Thus, where the viewers can be seated at the optimum viewing angle, usually a small group, daylight screens may be effective. However, such screens are very much more expensive than normal projection screens. A further alternative may be a rear-projection system in which the projection equipment is housed in a box, the image being projected on to a translucent screen via a mirror angled at 45° to the projection lens. Several commercially manufactured rear-projection systems are available, but these systems always employ a small screen, size around 8 X 10 in. (20 X 25 cm) and thus are more suitable for an individual or at most two or three persons to view. Therefore, it is recommended that a properly darkened room be provided.

When darkening a room by covering the windows with such materials as heavy drapes, opaque blinds or hardboard so as to exclude daylight, adequate ventilation for the audience is essential—otherwise viewers may become sleepy because of the stuffy atmosphere and unable to absorb the information being presented to them. This danger exists particularly in hot climates.

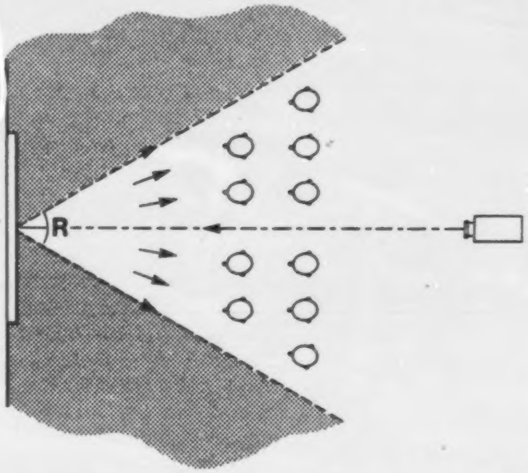
Projection of graphic materials is achieved by optical means, and each projection system has been designed for a specific purpose. The choice of equipment will depend on the type of graphic material to be presented, which can range from a simple hand drawing on paper or a page from a book or magazine, through transparencies, colour slides (with or without sound accompaniment) and filmstrips to the more sophisticated motion-picture presentations (see figure 22). An important factor governing the choice of projection equipment (known as hardware) and the selection of the graphic medium (known as software) will be the availability of back-up facilities such as artwork and photographic



Typical reflection of three popular types of front projection screens:
(a) matt white, (b) patterned white, and (c) glass beaded.

Figure 21. Front-projection screen

Courtesy of Philips



With an ideal projection screen, the light would be reflected evenly towards the audience within a reflection area R, and no light would be lost outside the area.

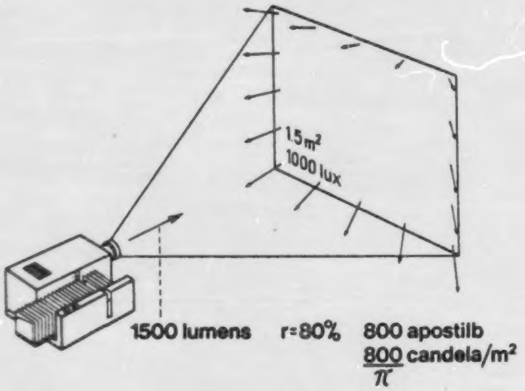
Figure 22. Light area for projection screen

Courtesy of Philips

equipment and skills. The amount of funds available for a project will be a decisive factor. The user must determine the cost-effectiveness of a chosen system by relating it to his specific needs as well as to his local resources.

Power supply

All types of hardware for projection require an electric power supply to operate the light source as well as cooling fans and projection motor. Even the simplest equipment needs current to power the projection lamp. When ordering equipment, be certain that it will operate on the local mains supply. First, check the local supply to see whether it is AC or DC. For example, most projection equipment using electric motors operates on AC current only. You should know the local voltage as well as the frequency in the case of AC current. It will normally be either 50 Hz or 60 Hz, depending on the part of the world. Most projection hardware discussed in this chapter will have a variable voltage control for the input, and some equipment will also have a facility to operate on 50 Hz or 60 Hz. If you have any doubts about the local supply voltage and frequency, consult the local power company. When ordering equipment, be sure to specify voltage and frequency. In areas having DC power supply only, special care will be needed, since there will be problems with equipment operating on AC motors. Where the required hardware is available only in AC power, it is possible by consulting local electrical engineers to arrange for the installation of a power convertor that will convert a DC supply into the required AC voltage and frequency.



With projection techniques, various specific photometric concepts are used. A projector may produce, for example, a luminous flux of 1500 lumens on a screen of 1.5 m^3. The illumination of the screen is then 1000 lumens/m^2 or 1000 lux. If the screen has a reflection coefficient (r) of 80% its luminance will be 800 apostilb or 800/π candela/m^2 = 255 cd/m^3. The units and their mutual relationship are defined by international agreements.

Figure 23. Power requirements for front projection

Courtesy of Philips

When it is necessary to operate equipment in the field, i.e. in areas where there is no mains power supply, a convertor can be obtained that can be driven from a heavy-duty car battery. Such a convertor will then produce the current to power the equipment. Here again, the power requirements of the hardware must be specified when ordering a convertor (see figure 23).

Still-projection hardware

Episcope

The episcope is a very simple, yet highly flexible and effective projection device, relatively inexpensive and easy to use. It consists of a metal housing that contains a powerful projection lamp, a mirror and a projection lens. The mirror is placed at 45° to the optical axis of the lens and is arranged so that any kind of graphic material placed underneath the housing, in the space provided, will be illuminated by the light source. The illuminated graphic is reflected by the mirror into the projection lens, which throws the picture on to the screen (see figure 24).

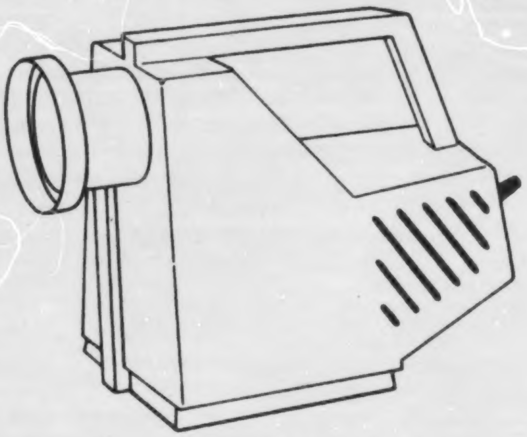


Figure 24. The episcope

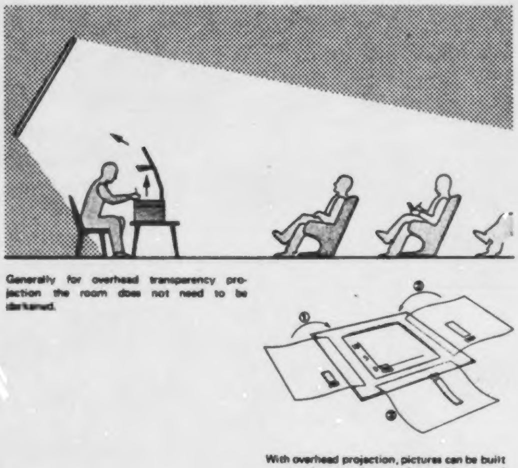
The size of the projected image on the screen is determined by the distance of the episcope from the screen and the focal length of the projection lens. A wide range of graphic material may be presented with this equipment; simple hand drawings on paper, pages from a book or magazine, photographs and even fairly flat objects such as a pair of scissors or a printed circuit board. Using a little imagination, even movement can be screened. For example, magnetism can be demonstrated by placing iron filings on a piece of white paper under which a small magnet is inserted during projection. A large image of this demonstration will be thrown on to the screen, and the filings will be seen moving into their polar positions.

Little can go wrong in using the episcope. The only servicing needed is to keep the mirror and lens clean. These are best cleaned by brushing gently with a soft camel's-hair brush or lightly dusting with a piece of soft linen. See that there is an adequate supply of spare projection lamps and that one is always available during a show or lecture.

Overhead projector

The overhead projector is one of the most popular projection devices for use in the class- or lecture room (see figure 25). It consists of a light-box housing a powerful projection lamp, which is aimed at a translucent area covering the top of the box forming a flat illuminated table. Usually, there is a Fresnel lens beneath the table, which ensures even distribution of the projection lamp over the working surface. An upright column is fitted to the side of the light-box that carries a projection lens and a mirror set at 45° to the optical axis of the lens and the working surface of the light-box. The whole of this assembly can be adjusted vertically so that the distance of the lens unit from the light-box platform can be varied (see figure 26).

Some makes of overhead projectors have a fully rotatable lens head, which permits the user to face the equipment in whatever direction is most convenient. Further useful refinements to this device consist of a heat filter between the light source and the working platform, a thermostatically controlled cooling fan and roll holders fitted to each side of the light-box to carry a roll of transparent material across the top of the light-box. All these refinements are desirable, and any make of machine being considered should include them.



Generally for overhead transparency projection the room does not need to be darkened.

With overhead projection, pictures can be built up step by step through the combination of pre-prepared transparent sheets.

Figure 25. The overhead projector

Courtesy of Philips

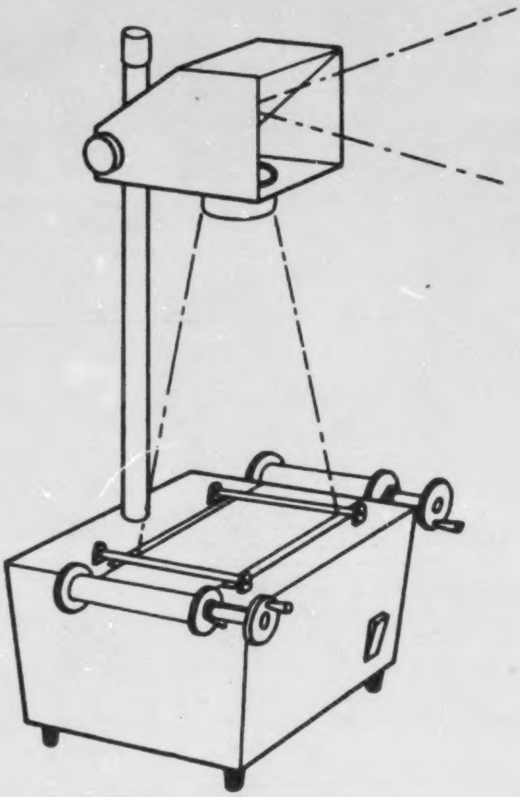


Figure 26. Light-box platform and the overhead projector

In use, any transparency, either previously prepared, commercially published or drawn on a blank section of the transparent roll during the lecture, may be projected on to the screen, with a large, bright image. The average size of the illuminated platform forming the working area is about 10 X 10 in. (25 X 25 cm). The teacher has a wide variety of options he may employ to present visual material. He may draw facts, figures, pictures and diagrams on the clear transparent film during the lecture. Virtually, the system becomes a sophisticated chalkboard, since the lecturer can draw or write his information, using, if required, different coloured pencils. While listening to the lecturer, the viewers see the visual as it is being drawn. Making use of the roll holders that carry a roll of transparent film material enables the lecturer to bring a fresh drawing area over the light-box very easily. It also permits him to refer back to previous information by winding back.

The overhead projector is now firmly established as an indispensable training aid in the industrialized countries and is used widely in education and industry. Many large international industrial organizations have had special programmes produced for use on overhead projectors. Such programmes consist of a specially prepared book, containing a full set of multicoloured transparencies bound together with the lecture notes in such a way that the appropriate notes appear opposite the transparency being used. These books are printed in quantity and in different languages, which makes a standard of information and training possible. The programme books are spiral bound, thus permitting each transparency to be laid flat on the projection table. One major automobile company uses this method for service training throughout Europe and the United States.

Slide projector

Historically, the slide projector was probably the earliest picture projection device. In the nineteenth century, it was known as the magic lantern and consisted of a large metal box housing a strong light source, such as gas or acetylene, which faced a simple condenser lens at the front of the box. This lens concentrated the light on a square aperture, in front of which was a wooden slide carrier that carried two glass slides, the carrier being arranged so that it could be pulled to and fro horizontally across the illuminated aperture. A projection lens was mounted in front of the slide carrier and thus threw a large image of the slide on to a screen. While one slide was being shown, the next slide in a series could be inserted into the other space in the carrier; and by pulling the carrier across, the next slide would be projected. By inserting new slides into each side of the carrier as it was moved from left to right and removing the previously projected slide, a continuous presentation could be made of any length and with any number of slides.

No doubt the name "slide" derived from the process of sliding the picture carrier to and fro during what in those days was called a "lantern lecture". Either the lecturer operated the slide projector himself, while delivering his lecture, or an assistant fed the slides in the projector in the order the lecturer had arranged beforehand. The lecturer was then able to deliver his lecture near the screen at the front of the audience and signal to his assistant to change slides by snapping his fingers or using a small castanet.

In those early days, the slides were large in area, at least 3¼ X 3¼ in. (8.3 X 8.3 cm), and pictures or diagrams were hand-drawn on the glass surface. Different colours were used for greater effect. Then, as the art and technique of photography developed, it became possible to print photographic negatives on specially prepared glass slides carrying a photographic emulsion and thus project a large positive picture in black and white. Today, with the progress of photographic techniques and skills, slide projectors have become much more sophisticated. Nevertheless, they employ the first principles of the early machines (see figure 27).

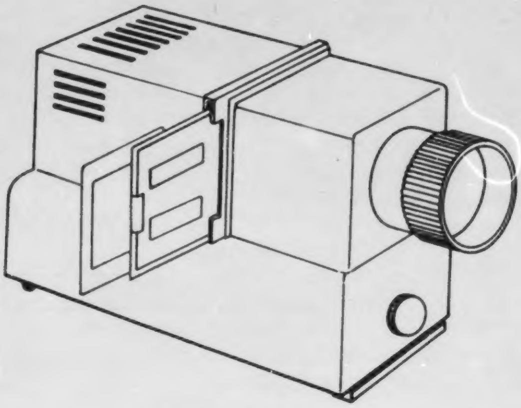


Figure 27. Slide projector

Since the advent of 35mm cameras for still photography together with modern colour films, most slide projectors are now in the 35mm format. The simplest and least expensive kind of projector is a modern miniature version of the old magic lantern. It consists of a lamp housing containing a high-power projection lamp, a condenser lens, slide carrier and projection lens, the whole being compact, highly portable and inexpensive. The only electrical part is the projection lamp, which can be ordered either in mains or battery supply. Some simple 35mm slide projectors have low-voltage projection lamps and have a built-in transformer to reduce the mains current to the required voltage for the lamp. Often, the lamp voltage is 12 volts, which means the equipment can be operated from either the mains or from a car battery.

Slides for 35mm slide projectors are the same size in picture area as the standard 35mm still camera, i.e. 24 X 36 mm. The basic 35mm slide projector can be a very effective visual tool for presenting pictures taken on a modern 35mm camera. Today, these cameras have become very easy to use because they have automatic exposure systems built into them. By using reversal-type colour film, the user can photograph the scenes needed to cover a subject in pictures. The exposed film is then sent to the nearest processing station and the pictures are returned, mounted in card slide mounts, ready for projection. Naturally, the resulting pictures will depend entirely on the skill and imagination of the photographer. This method of making pictorial slides in colour is suggested as a basic technique for producing pictures on any given subject and presenting them on the basic slide projector described.

The use of this simple method of producing and presenting slides can be recommended where no sophisticated photographic and artwork facilities exist. Although only a 35mm still camera and compact slide projector are required, the person making and presenting the programme must prepare the content carefully, as with any teaching or information programme. A logical sequence of pictures to be taken to cover the subject should be worked out on paper, together with the text to accompany each picture. Thought should be given to the value of close-up pictures related to a wide-view picture, because these close-up details will add impact and clarity to the programme.

Where funds permit, the purchase of a more expensive 35mm camera of the single-lens reflex type is to be recommended because it enables the user to photograph close-up detail with great accuracy. Such cameras can usually be supplied with a series of close-up dioptre lenses that can be fitted to the front of the camera lens, which makes it possible to photograph very small objects in extreme close-up. This facility will prove of great value, especially in industrial training. It also enables slides to be made of existing charts or drawings and the copying on to slides of other graphic material.

When all the material has been photographed, it is returned from the processing station with each frame of film cut and in a card slide mount. These card mounts are suitable for short-term use; if a more permanent storage method is needed, the laboratory processing the film should be instructed not to mount the frames of finished reversal-type colour film but to return them unmounted. Special 35mm glass slide containers can be obtained from the projector suppliers and the individual frames mounted in these holders. This method prevents any damage to the film and is recommended for permanent storage.

There is only one correct way of inserting a slide into the slide carrier on the projector. Because of the optical system in the projector, the picture image is inverted through the lens. For this reason, slides must be put into the slide carrier upside-down. There is also only one correct position for the slide as far as the relation of the surfaces of the slide to the light source is concerned; which side faces the light source depends on the type of material the slide was originated in. The 35mm film frame on which the slide was photographed will have an emulsion side, which is identified by its matt surface, the other side being the film material, which is shiny. For material produced on colour reversal film, the film base or shiny side must face the light source and the emulsion side should face the projection lens.

A useful method for ensuring that slides are always loaded into the projector properly is to fix a small piece of adhesive paper to the top right-hand corner of the slide mount when it is in its proper position for projection. The slide number can be written on this small paper area, which is a means of indexing a series of slides as well as ensuring that they always appear on the screen properly. For simple hand-drawn information, a special blank, opaque slide with a surface on which information can be drawn or written is available. These slides, known as Ektagraph slides, are useful for uncomplicated graphic information, but the area available to be written or drawn on is only 24 X 36 mm. These special slides are available only from the Kodak Company.

So far, the simple slide projector and methods of making pictorial slides for it have been discussed. However, more sophisticated slide projectors with built-in electro-mechanical features that permit automatic projection of slides are available. They are all based on the same principles as a simple slide machine but have added facilities.

Some projectors accept plastic slide magazines holding up to 50 slides. These magazines are simply a plastic box with a series of grooves into which the slides are loaded. Thus, a complete programme may be loaded correctly and stored ready for projection. The slide magazine in this type of automatic projector is oblong and fits into a channel built into the side of the projector. The least expensive type of magazine slide projector is hand-operated. When the magazine is in position, with the first slide aligned opposite the projector aperture, a metal carrier is pushed in, carrying with it the first slide. When the carrier is withdrawn, the first slide is replaced in its slot in the magazine; then when the carrier is moved forward again, a ratchet mechanism moves the magazine up to align the next slide in the series and in this way the whole magazine can be shown.

A more sophisticated magazine slide projector employs an electro-mechanical drive to operate the slide mechanism. A remote-control cable is plugged into the projector with a push-button on the end. The lecturer may then change slides in the magazine as far as 30 ft (9 m) from the projector, at his own pace, to suit the lecture. A further refinement is to extend the electro-mechanics of the projector so that momentary pressure on the control button advances the next slide while a longer pressure causes the magazine to move backwards, which permits retrieval of a previously shown slide, a useful feature when the lecturer wishes to refer back for emphasis.

Another additional refinement is the provision of an automatic timer that can be set at different times, so that each slide is projected automatically and the duration it is held on the screen is determined by the variable timer control. This facility is mainly used in exhibitions; it is not essential for training purposes.

The most sophisticated automatic slide projectors have, in addition to the remote slide-change button, another control built into the machine and remotely controlled by the cable, which permits the focus of the projector to be adjusted. Some machines even have a small optical unit built into the control unit at the end of the remote-control cable that permits the lecturer to project a small white image of an arrow that can be superimposed on the projected picture so as to point out specific details in the picture.

Where many slides are to be presented or stored, circular wheel-type magazines that sit in the magazine channel of the projector and can hold up to 100

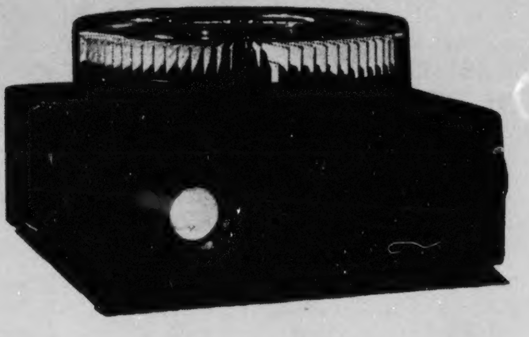


Figure 28. Carousel S-AV 2000 projector

Courtesy of Kodak

slides are useful. The magazine rotates at each slide change, being drive by the same ratchet mechanism mentioned above.

Another machine is designed to take circular slide trays fitted to it horizontally. These trays take up to 80 slides, but the machine will accept only this type of magazine. In all other respects it has the same remote-control and automatic features as the flat, oblong magazine type of machine, but has a particular advantage so far as slide containers are concerned. With the plastic magazine box or circular plastic magazine driven by a ratchet, the magazine cover securing the slides for transportation must be removed before the magazine can be inserted. When the cover is removed, the magazine may be tipped

The following table shows the distance from the screen at which to set up your projector for:

- ☐ a given screen size
- ☐ a given slide aperture size (nominal)
- ☐ a given lens

The distances given are the lens-to-screen distances

Focal length of lens in mm	28		35			
Slide aperture size in mm	28 x 28		24 x 36		28 x 28	
Screen width in inches	Lens-to-screen distance				Lens-to-screen distance	
	ft	in	ft	in	ft	in
12	1	0	1	0	1	3
18	1	6	1	6	2	0
24	2	0	2	0	2	9
36	3	3	3	3	4	0
48	4	3	4	3	5	6
59	5	3	5	3	6	6
69	6	0	6	0	7	9
76	6	9	6	9	8	6

Focal length of lens in mm	60								85							
Slide aperture size in mm	24 x 36		28 x 28		24 x 24 and 18 x 24		40 x 40 and 28 x 40		24 x 36		28 x 28		24 x 24 and 18 x 24		40 x 40 and 28 x 40	
Screen width in inches	Lens-to-screen distance								Lens-to-screen distance							
	ft	in	ft	in	ft	in	ft	in	ft	in	ft	in	ft	in	ft	in
36	5	4	6	8	7	2	4	9	8	10	8	11	9	11	6	1
48	6	11	8	9	9	10	6	5	9	3	11	11	13	4	8	3
59	8	5	11	2	12	0	7	5	11	11	15	5	17	0	10	6
69	9	9	12	10	14	3	9	0	14	10	19	2	21	5	13	4
76	11	0	14	2	15	3	9	10	16	6	20	11	23	6	14	7
90	13	3	16	9	18	7	11	8	19	5	25	0	27	9	17	6
104	15	1	19	3	21	9	13	7	22	2	28	6	31	8	19	10
116	16	10	20	8	24	3	15	3	24	7	31	7	35	0	21	10
122	17	5	22	11	26	0	16	0	25	8	33	2	37	0	23	1

Focal length of lens in mm	100								150							
Slide aperture size in mm	24 x 36		28 x 28		24 x 24 and 18 x 24		40 x 40 and 28 x 40		24 x 36		28 x 28		24 x 24 and 18 x 24		40 x 40 and 28 x 40	
Screen width in inches	Lens-to-screen distance								Lens-to-screen distance							
	ft	in	ft	in	ft	in	ft	in	ft	in	ft	in	ft	in	ft	in
36	8	8	11	5	12	6	7	10	12	6	16	0	17	9	11	2
48	11	11	15	2	16	7	10	8	16	11	21	8	23	9	14	11
59	14	8	18	10	20	10	13	2	20	8	26	7	29	4	18	6
69	17	1	21	9	24	2	15	4	24	5	31	2	34	5	21	7
76	19	2	24	10	27	9	17	4	27	6	35	3	39	2	24	6
90	22	9	28	8	32	4	20	4	32	5	41	5	46	1	28	7
104	25	11½	33	1	37	3	23	2	37	5	48	6	53	2	33	6
116	29	1	37	0	41	3	25	9	41	9	53	11	62	1	37	4
122	30	6	38	10	43	3	26	11	44	2	56	0	65	4	41	6

	180								250							
	ft	in	ft	in	ft	in	ft	in	ft	in	ft	in	ft	in	ft	in
36	16	4	21	2	23	8	14	9	22	2	27	11	31	6	19	9
48	21	10	27	11	31	4	19	7	29	3	38	0	42	11	26	5
59	27	3	32	4	39	8	23	3	36	1	46	2	52	0	32	1
69	30	10	39	6	44	5	27	5	41	0	53	1	59	0	36	3
76	33	0	43	8	47	2	30	4	44	10	57	9	64	10	40	6
90	40	3	51	6	58	6	35	9	53	2	68	5	77	6	47	5
104	46	0	59	3	67	8	41	5	61	10	78	11			55	4
116	51	5	66	6	75	8	46	2	68	6					61	6
122	54	3	71	0	79	10	48	3	72	2					64	3

	70						120					
	ft	in	ft	in	ft	in	ft	in	ft	in	ft	in
36	6	6	7	11	9	2	10	5	13	5	15	1
48	8	0	10	9	12	0	13	11	17	8	20	5
59	9	11	13	0	14	7	16	11	22	3	24	10
69	11	7	15	5	17	2	19	9	25	7	28	11
76	12	9	16	10	19	0	21	8	28	4	31	5
90	15	0	19	9	22	2	25	9	33	5	37	10
104	17	7	23	0	25	8	29	7	37	9	42	10
116	19	3	25	3	28	7	31	7	40	8	46	3
122	20	2	28	4	29	7	34	8	44	10	50	2

With the 24 x 36mm format, the height of the picture will be $1/2$ of the screen width, with the 18 x 24mm format, it will be $3/4$ of the screen width.

Figure 29a. Projection distance table–feet/inches

Courtesy of Kodak

over accidentally during handling; the slides fall out and much time can be wasted before a show reinserting them in the proper order. With the machine employing the circular tray that fits flat and horizontally into the machine, the slides, once loaded, are kept in place permanently by a sleeve with a central flange fitted into the centre of the magazine. This type of automatic slide projector is manufactured only by the Kodak Company and is called the Carousel (see figure 28).

Summarizing the automatic projectors, several manufacturers produce the type of machine accepting the plastic box magazine, some of which also accept the large-capacity circular magazine. The nearest local photographic or audio-visual dealer should be consulted if this type of machine is required. The Carousel machine is usually distributed by audio-visual dealers; otherwise the nearest Kodak office should be consulted.

Setting up a slide presentation

Whichever slide projector is finally chosen, a slide lecture must be prepared properly. Ideally, a permanent lecture room in which all the audio-visual equipment is located, ready for use, is desirable, though it may not always be possible to provide such a room, particularly when the equipment is taken out to a location or used in the field. In any event, the

The following table shows the distance from the screen at which to set up your projector for:

☐ a given screen size
☐ a given slide aperture size (nominal)
☐ a given lens

The distances given are the lens-to-screen distances.

Focal length of lens in mm	28	35	
Slide aperture size in mm	28 x 28	24 x 36	28 x 28
Screen width in metres	Lens-to-screen distance metres	Lens-to-screen distance metres	metres
0.3	0.3	0.3	0.4
0.5	0.5	0.5	0.6
0.6	0.6	0.6	0.8
0.9	1.0	1.0	1.2
1.2	1.3	1.3	1.7
1.5	1.6	1.6	2.0
1.8	1.8	1.8	2.4
1.9	2.0	2.0	2.6

Focal length of lens in mm	60				85				100				150			
Slide aperture size in mm	24 x 36	28 x 28	24 x 24 and 18 x 24	40 x 40 and 28 x 40	24 x 36	28 x 28	24 x 24 and 18 x 24	40 x 40 and 28 x 40	24 x 36	28 x 28	24 x 24 and 18 x 24	40 x 40 and 28 x 40	24 x 36	28 x 28	24 x 24 and 18 x 24	40 x 40 and 28 x 40
Screen width in m	Lens-to-screen distance (m)				Lens-to-screen distance (m)				Lens-to-screen distance (m)				Lens-to-screen distance (m)			
0.9	1.6	2.0	2.2	1.4	2.0	2.7	3.0	1.9	2.7	3.5	3.8	2.4	3.8	4.9	5.4	3.4
1.2	2.1	2.7	3.0	2.0	2.8	3.6	4.0	2.5	3.6	4.6	5.0	3.2	5.1	6.6	7.2	4.5
1.5	2.6	3.4	3.6	2.2	3.7	4.7	5.1	3.2	4.4	5.7	6.3	4.0	6.2	8.1	8.9	5.6
1.8	3.0	3.9	4.3	2.7	4.5	5.8	6.5	4.0	5.2	6.6	7.3	4.7	7.4	9.4	10.5	6.6
1.9	3.3	4.3	4.6	3.0	5.0	6.4	7.1	4.4	5.8	7.6	8.5	5.3	8.4	10.7	11.9	7.5
2.3	4.0	5.1	5.7	3.6	5.9	7.6	8.5	5.3	6.9	8.7	9.9	6.2	9.9	12.6	14.0	8.7
2.6	4.6	5.9	6.6	4.1	6.8	8.9	9.6	6.0	8.2	10.0	11.4	7.0	11.4	14.8	16.2	10.2
2.9	5.1	6.3	7.4	4.6	7.5	9.6	10.7	6.7	8.8	11.3	12.6	7.8	12.7	16.4	18.9	11.4
3.1	5.3	7.0	7.9	4.9	7.8	10.1	11.3	7.0	9.3	11.8	13.2	8.2	13.5	17.1	19.9	12.6
	180 (m)				250 (m)				70 (m)				120 (m)			
0.9	5.0	6.5	7.2	4.5	6.8	8.5	9.6	6.0	2.0	2.4	2.8		3.2	4.0	4.6	
1.2	6.7	8.5	9.5	6.0	8.9	11.6	13.0	8.0	2.4	3.3	3.7		4.2	5.4	6.2	
1.5	8.3	9.9	12.0	7.0	11.0	14.0	15.8	9.8	3.0	4.0	4.4		5.2	6.8	7.6	
1.8	9.4	12.0	13.5	8.4	12.5	16.2	18.0	11.0	3.5	4.7	5.2		6.0	7.8	8.8	
1.9	10.1	13.3	14.4	9.2	13.7	17.6	19.8	12.3	3.9	5.1	5.8		6.6	8.6	9.6	
2.3	12.3	15.7	17.8	10.9	16.2	20.9	23.6	14.5	4.6	6.0	6.8		7.8	10.1	11.5	
2.6	14.0	18.0	20.7	12.6	18.8	24.0		16.9	5.4	7.0	7.8		9.0	11.5	13.1	
2.9	15.7	20.3	23.1	14.1	20.9			18.7	5.9	7.7	8.7		9.6	12.4	14.1	
3.1	16.5	21.6	24.3	14.7	22.0			19.6	6.1	8.0	9.0		10.6	13.7	15.3	

With the 24 x 36mm format, the height of the picture will be $^1/_2$ of the screen width, with the 18 x 24mm format, it will be $^3/_4$ of the screen width.

Figure 29b. Projection distance table–metric

Courtesy of Kodak

following measures should be taken to ensure a smooth and efficient presentation:

(a) A firm table or stand must be provided for the projector. It must be of sufficient height to clear the heads of the viewing audience. If a lower table has to be used, the viewers' seats should be so arranged that heads do not obstruct the beam from projector to screen. Make a check after siting the projector on its table at the back of the room by arranging the chairs and sitting in seats near the centre of the room with the projector throwing an image on to the screen;

(b) The projected picture size will depend upon the distance of the projector from the screen and the focal length of the projection lens. A chart showing projection distances, lens focal lengths and picture sizes is a useful aid to planning (see figures 29a and 29b). Where funds permit, a selection of two or three projection lenses, of different focal lengths, should be ordered with the projector. Lenses of variable focal length, known as zoom lenses, are usually supplied with the more sophisticated machines. Such lenses, while more expensive than a single normal lens, are probably no more expensive than a selection of different lenses and are much more flexible. A zoom lens can be adjusted to vary the projected picture size to fit the screen without moving the projector. It is particularly useful for presentations in the field where differing room sizes may be encountered;

(c) Check that the slides have been loaded correctly in the magazine. Where the simple, hand-operated slide projector is being used, make sure that the slides are in the proper order, preferably in a wooden slide box. The slides should be numbered with the white labels fixed to the upper right-hand corner (as previously described);

(d) The lecturer should have prepared lecture or teaching notes. The number and description of each slide should be written into the lecture notes to ensure smooth continuity. Subject headings together with each slide will often suffice if the subject is well known to the lecturer. When an assistant is used to operate the projector, a copy of the notes should be provided for him. Of course, where automatic remote-control projectors are used, no assistant is necessary;

(e) Make a final check before the presentation; see that a spare lamp for the projector is at hand. Ensure that any cables connecting the projector to the mains supply are placed so that no one can accidentally trip over them. See that someone is available to switch off the room lighting when necessary.

Making slides from composite graphic originals

A simple method of producing 35mm slides by direct photography with a camera has been described earlier. Where more sophisticated photographic and graphic skills are available, slides can be made that combine graphic and photographic material.

A simple example of this technique would be the production of a slide that contains a colour photograph, together with a written legend, such as a title and a slide number, appearing in the bottom right-hand corner when projected on to the screen. Such a slide is produced by making up a composite graphic carrying all the information and then rephotographing it on to a 35mm frame.

There are two methods of photography, depending on the number of copies of each slide needed. The composite should be photographed on to negative colour film from which any number of positive colour prints can be duplicated. Since 35mm cameras take up to 36 pictures in one loading, a complete run of 36 negatives can be produced. However, to do this, full colour-film developing facilities as well as printing equipment must be available, and such facilities are normally available at a central processing laboratory. The laboratory will also cut each frame of print film and mount it into a slide holder, usually of the glass type.

Where such facilities are not available, it is still possible to produce slides from composite graphics using reversal-type colour film and sending it off to the nearest processing station. A composite original is made up by using a reasonably large, blank white or black card, depending on the subject matter. The size of this card should be at least 8 X 10 in. (20 X 25 mm). A colour photograph can be mounted on the card and any additional graphic material drawn on the card in different colours, by hand. Thought must be given to the layout so as to produce an effective slide. The composite can then be photographed using a 35mm camera capable of focusing sufficiently close so as to fill the frame area with the composite. A single-lens reflex type camera is essential for this work. (See suggestions for choice of colours on page 58.)

Suggestions for making effective slides

Good slides amplify and clarify the message, stimulate interest, and help the speaker keep "on the track". Slides that cannot be read when projected lessen the impact and effectiveness of the presentation; in other words, the primary consideration is legibility. Although legibility was discussed in a previous chapter, it is referred to here specifically in relationship to the production of slides.

Ideally, the lecturer should work with a specialist who can translate information into effective visuals and who will instruct an artist and a photographer in making slides. Whether or not such assistance is available, some of the ways to make effective lecture slides are described below. While the emphasis is on 2 X 2 in. slides, the information applies also to other projected visuals.

CLOSE-UP LENS DATA

Close-up lenses and focus setting in feet		Lens-to-subject distance in inches	Approximate field size in inches for picture area in 2 x 2 inch slide	
			44 to 46 mm lens	50 mm lens
1 +	Infinity	39	21 x 30	18 x 26 1/2
	15	32 1/4	17 1/2 x 24 3/4	14 3/4 x 22
	6	25 1/2	13 1/4 x 19	11 1/2 x 17
	3 1/2	20 1/2	10 1/2 x 15	9 x 13 1/4
2 +	Infinity	19 1/2	10 1/8 x 15	9 x 13 1/4
	15	17 3/4	9 1/4 x 13 5/8	8 x 12
	6	15 1/4	7 3/4 x 11 1/2	7 x 10
	3 1/2	13 1/8	6 1/2 x 9 5/8	6 1/8 x 9
3 +	Infinity	13	6 3/4 x 10	6 x 8 7/8
	15	12 1/4	6 1/4 x 9 1/4	5 3/4 x 8 1/2
	6	11 1/8	5 5/8 x 8 3/8	5 x 7 1/4
	3 1/2	9 3/4	4 7/8 x 7 1/4	4 1/2 x 6 3/8
3 + plus 3 +	Infinity	6 3/4	3 7/16 x 5 1/8	3 1/16 x 4 9/16
	15	6 1/2	3 5/16 x 4 7/8	2 15/16 x 4 3/8
	6	6 1/8	3 1/8 x 4 11/16	2 13/16 x 4 1/8
	3 1/2	5 3/4	2 7/8 x 4 1/4	2 5/8 x 3 15/16

CLOSE-UP LENS DATA

Close-up lenses and focus setting in metres		Lens-to-subject distance in cm	Approximate field size in cm for picture area in 5 x 5 cm slide	
			44 to 46 lens	50 mm lens
1 +	Infinity	99	53.3 x 76.2	45.7 x 67.3
	4.57	81.9	44.4 x 62.9	37.5 x 55.9
	1.83	64.8	33.7 x 48.2	29.2 x 43.1
	1.06	52	26.7 x 38.1	22.9 x 33.7
2 +	Infinity	49.5	25.7 x 38.1	22.9 x 33.7
	4.57	45	23.5 x 34.7	20.3 x 30.5
	1.83	38.7	19.7 x 29.2	17.8 x 25.5
	1.06	33.3	16.5 x 24.6	15.6 x 22.9
3 +	Infinity	33	17.1 x 25.4	15.2 x 22.6
	4.57	31.1	15.9 x 23.5	14.6 x 21.6
	1.83	28.2	14.4 x 21.3	12.7 x 18.4
	1.06	24.8	12.4 x 18.4	11.4 x 16.2
3 + plus 3 +	Infinity	17.1	8.7 x 13	7.8 x 11.6
	4.57	16.5	8.4 x 12.4	7.5 x 11.1
	1.83	15.6	7.9 x 11.9	7.1 x 10.5
	1.06	14.6	7.3 x 10.8	6.8 x 10

Figure 30a. Overcrowded close-up lens data

CLOSE-UP LENS DATA (50 mm lens set for 3 1/2 ft)

Close-up lens	Lens-subject (inches)	Field size (inches)
1 +	20 1/2	9 x 13 1/4
2 +	13 1/8	6 1/8 x 9
3 +	9 3/4	4 1/2 x 6 3/8
3 + plus 3 +	5 3/4	2 5/8 x 3 15/16

CLOSE-UP LENS DATA (50 mm lens set for 1.06 metres)

Close-up lens	Lens-subject (cm)	Field size (cm)
1 +	52.07	22.86 x 33.66
2 +	33.3	15.6 x 22.86
3 +	24.76	11.43 x 16.19
3 + plus 3 +	14.6	6.79 x 10

Figure 30b. Essential close-up lens data

Courtesy of Kodak

Errors in making slides and how to avoid them

Most errors in making slides arise from the mistaken assumption that legibility in one form assures legibility in another. The image projected on a screen may be 6 ft (1.8 m) wide, but to an observer in the back row, 70 ft (21 m) away, it appears to be the same width as a picture only 1 in. (25 mm) wide viewed at his normal viewing distance of 12-14 in. (30-35 cm). It is no wonder that only the title may be legible.

The table in figure 30a is too crowded with data. In such situations either reduce the data to essential and rounded figures only or present representative data in smaller groupings, as shown in figure 30b. Two or more simple slides are better than one complicated slide.

The copy area in figure 30b is in actual working size, chosen for the height-to-width ratio of the artwork area. Filling a large area with more typewritten copy would reduce legibility.

Artwork need not be shown in its entirety, unless all the surroundings of a particular operation are important. Maybe an overall view and a close-up are needed. A close-up presents important details clearly and results in a less distracting image on the screen. Where possible, any necessary cropping should be done during the original photography.

If a blueprint is reduced to slide form and projected, the screen image will be illegible (see figure 31). Lines will be too faint, lettering will be too small, and the narrator will usually lose his audience while trying to explain in words what the audience should be seeing. Either a thick-line tracing made with crayon, felt-tip pen etc. of essentials or a simplified version, as shown in figure 32, is preferable.

When typing copy for slides use this template: 9 double-spaced lines (maximum) and 54 élite (or 45 pica) characters wide. Upper and lower-case élite type will be legible up to 48 ft (14.6 m) from a projected image 5 ft (1.5 m) high; pica type to about 64 ft (19.5 m). The use of upper-case letters only will extend the legibility distance somewhat. Keep

Figure 31. Sample of illegibility resulting from small lettering and poor diagram

Courtesy of Kodak

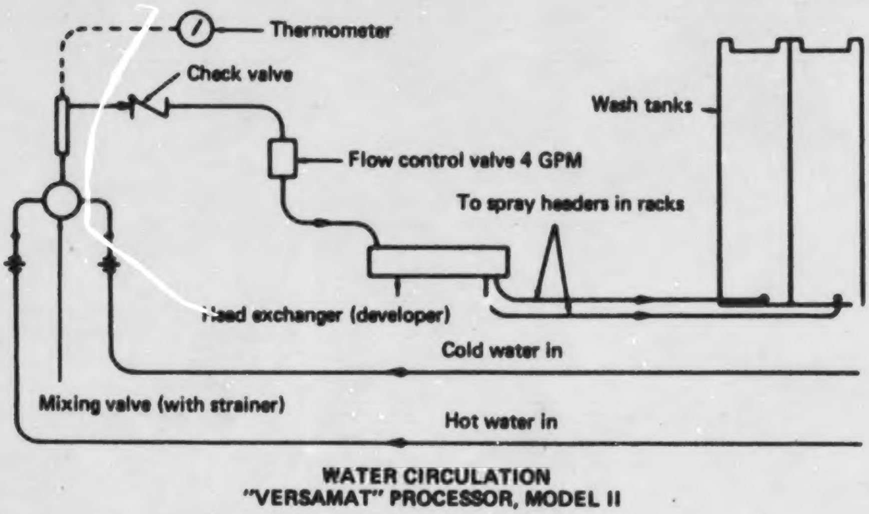

Thermometer
Check valve
Wash tanks
Flow control valve 4 GPM
To spray headers in racks
Heat exchanger (developer)
Cold water in
Mixing valve (with strainer)
Hot water in
WATER CIRCULATION
"VERSAMAT" PROCESSOR, MODEL II

Figure 32. Right size of lettering and diagram

Courtesy of Kodak

captions, lines or other markings (added to illustrations from which slides will be made) within the rectangle. Use the template as a guide for setting up your camera; the view-finder should include about 1/8 in. outside the template area on all slides.

It may be helpful to trace the template on onion-skin or clear plastic material that can be used to check copy area, and to align the camera. (Be sure to remove the tracing before photographing the copy.)

Observe these important points:

(a) Use 2 X 2 in. colour slides—they are effective, easy to make and inexpensive. Colour film is also convenient for making slides from black-and-white copy;

(b) Use a dark-coloured background—it is better than black or white;

(c) Limit each slide to one main idea;

(d) Use a slide series for progressive disclosure—it clarifies greatly;

(e) Limit each slide to 15-20 words, or 25-30 elements; include no more than you will discuss;

(f) Leave space—at least the height of a capital letter—between lines;

(g) Include titles to supplement, not duplicate, slide data;

(h) Use several simple slides rather than one complicated one, especially if you must discuss a subject at length;

(i) Use duplicates if you need to refer to the same slide several times in your talk. It is impractical for the projectionist to search for a slide to re-show it;

(j) Plan your slides for a good visual pace in your presentation. Do not leave a slide on the screen after discussing its subject;

(k) Thumb-spot all slides in the lower left corner when the slide reads correctly on hand viewing. Add sequence numbers.

To prepare for a smooth presentation:

(a) Rehearse your slide presentation several times, so that you will be familiar with the sequence and timing of the slides;

(b) Several days in advance, let the programme chairman know the size and mounting of your slides and the kind of tray you will use, so that he will be sure to provide the right projector. Be sure you use a widely accepted mount;

(c) On your trip, carry your slides with you—in the tray, if possible. Do not trust them to your baggage if it is checked through;

(d) Speak with the projectionist early concerning the required projector. If necessary, plan for the time it will take to load a projector tray;

(e) Request a projector with remote control that you can operate from the lectern. Otherwise, have a signal light for the projectionist or arrange some other means, for instance, a copy of the commentary marked to show the slide changes;

(f) Give your slides to the projectionist before the meeting, when you have time to discuss any special instructions with him. If you wait until just before your talk, he may then be busy with the previous speaker's slides;

(g) Use the slides to supplement and support your oral presentation, not simply to repeat what you are saying;

(h) Use a pointer, if needed (but be sure you know how to use it);

(i) Consider your audience size in terms of screen size and projector output. As an example, an audience of over 400 needs a screen image 8 ft (2.4 m) high.

Adding sound to slide programmes

Most of the more sophisticated automatic slide projectors are equipped for automatic synchronization of sound from a tape or cassette recorder/player. The programme information is carried on one of the two tracks on the tape, e.g. commentary; the other track carries signals, or pulses, that are recorded on the tape at the exact moment a slide change is required. These pulses are fed by a connecting cable to a socket in the projector, and in this way each slide changes automatically at exactly the correct moment during the programme. However, it is not possible to make use of an ordinary standard tape or cassette recorder. A specially made tape machine, provided with the additional record/playback head to record and replay the pulses is required. While reel-to-reel machines of this type can be found, the Philips-type cassette machine is more popular because it is inexpensive and portable. Such cassette machines are available for mains or battery operation and can be supplied with a pulsing unit so that a slide programme can be recorded and pulsed on the spot. This system is very useful when an experienced lecturer on a subject is not available because a trained assistant can present a programme with a prerecorded commentary made by the subject expert. However, it must be emphasized that while information can be presented accurately in this way, it can never be as effective as a programme delivered by the lecturer in person. The lecturer can be flexible and can retrace where he feels it is necessary, as well as be able to answer questions and deal with a discussion on the subject. Operating instructions for slide/tape-sound synchronism with cassette tapes are provided with the cassette recorder and pulsing equipment.

Filmstrip projectors

The filmstrip projector employs exactly the same optical principles as the slide projector, but instead of separate 35mm slides being used, the programme material for the visual is carried on a length of 35mm film. The film is exactly the same as film used in 35mm motion pictures, except that the individual frames are projected as still pictures. The frame size of the picture is 24 X 18 mm, i.e. half the size of the frame size in a 35mm slide. There is no slide carrier in a filmstrip machine. The carrier is replaced by a small roller on an arm at the top of the machine from which the 35mm roll of pictures is fed into the projection aperture. There is a simple sprocket drive that engages with the perforations on the edges of the film, thus feeding each frame into position in the projection aperture. Below the aperture there is a take-up roller on to which the leading end of the film is threaded. In the simple type of projector, frames are advanced by hand, by turning a winder linked to the sprocket wheel. Figure 33 illustrates the layout of a conventional filmstrip projector.

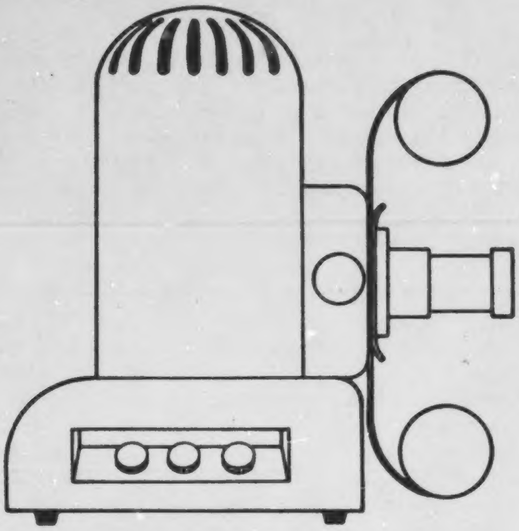


Figure 33. Conventional filmstrip projector

Like the slide projector, the filmstrip projector is available in a range of models from the simple hand-operated machine to a fully automatic projector fitted with tape/sound and pulse equipment so that the presentation can be automatic and sound synchronized with picture (see figure 34). The same type of special cassette recorder and pulse unit as used for slide machines can be used with the automatic filmstrip projector. The more sophisticated models employ a small cassette to hold the film, which is threaded by the machine automatically.

There are advantages and disadvantages in using this type of still-picture projector. The main advantage is that the filmstrip can carry a large number of single frames. There are 16 frames to each foot of 35mm film and a series of 100 or more frames can be contained in only a few feet of film. Thus, very little space is taken up and storage is easy. However, any rearrangement of individual frames in a filmstrip programme is impossible without remaking the entire programme.

With slide projectors and slides, alteration and updating of single slides is easy. The composite graphic originals are prepared in exactly the same manner as for slides. Unless there are very complete photographic facilities available, the filmstrip is not the sort of visual programme that the training personnel can produce. Filmstrips have to be photographed on to the 35mm negative with a special 35mm rostrum camera, which in the industrialized countries is carried out by specialist houses or photo-laboratories. Therefore, the filmstrip projector is recommended only where there are published filmstrips suitable for a training course. For local production, slides are to be preferred.

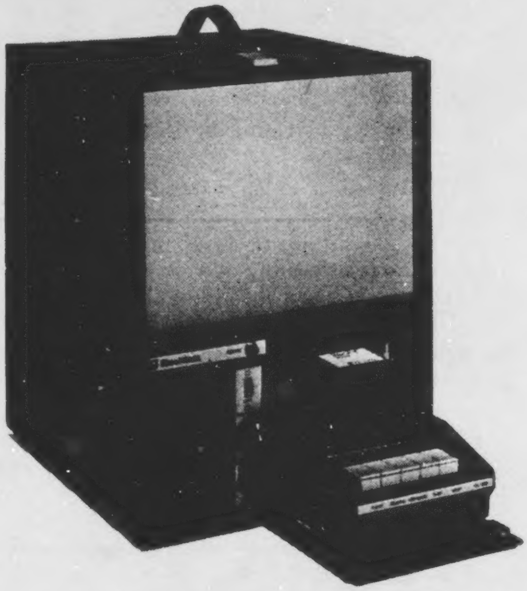


Figure 34. Filmosound self-contained 35mm daylight strip projector

Courtesy of Bell and Howell

Summary

There is no doubt that projected slides or photovisuals have become an extremely effective tool in solving many current communications problems. They are used widely in education, business and industry and government—people in all fields are making more and more use of visual aids because of increased awareness of the need for good communication.

There is a wide range of equipment to choose from to suit every need, from the simple hand-operated projector to the fully automatic machine with synchronized sound from a tape cassette. The only limitation is that slide projectors present still pictures and if movement is required or is necessary, then a motion-picture projector must be used.

VIII. Motion pictures

Background

Since the invention of the motion-picture film at the end of the nineteenth century, "movies" have been regarded by the public mainly as an entertainment medium. Nevertheless, almost from the time of their invention, the potential of the film as a teaching medium was recognized. However, in those early days, all motion pictures were made on 35mm film, and the projection equipment was cumbersome. Since one of the main objectives at the time was for the films to make money, little thought was given to using them for instruction.

Certainly, the early silent newsreels were an example of the use of film for informational purposes. Then the documentary film was developed, even before sound films were possible.

The term "documentary" was first used in regard to a special kind of film by the late John Grierson, in 1926, when he reviewed *Mona*, a film about the South Sea Islands made by Robert Flaherty. The difference between an entertainment film and a documentary is that the former employs actors in fictional situations and the latter non-actors in real-life situations. Grierson defined "documentary film" as "the creative interpretation of reality". Grierson established the documentary films firmly in the early 1930s, when he opened the British Empire Marketing Board Film Unit and following that the British GPO Film Unit. By then, the sound film had emerged and the GPO Film Unit became known internationally as producers of excellent documentary films that were used for informing the public on activities of the British Post Office. *Night Mail*, an account of the journey of the night mail train from London to Glasgow, is a classic film where the talents of the documentary director were combined with those of the poet W. H. Auden and the composer Benjamin Britten.

The GPO Film Unit pioneered the use of the 16mm sound projector. A number of projectors were acquired together with all the necessary accessories, speakers, screens etc. Thus projectionists were able to travel around the country, giving shows of their films to Womens' Institutes, schools, universities and the like. These shows established the non-theatrical use of film, and the popularity and use of the 16mm projector grew rapidly. Documentary films were and are used for conveying to the viewer a first-hand experience of a subject. However, they do not teach specifically. Rather, they give background information on a subject and stimulate interest and a desire to learn more.

A further and natural development was to produce a visual aids package consisting of a documentary sound film, a set of slides to teach details of the subject and a carefully prepared set of lecture notes that could be given to the trainee. In this way the training film in various forms emerged: 16mm projectors became more sophisticated and highly portable and then the 8mm and Super 8mm rear-projection, single-concept loop machines were developed. Before the technical details of the variety of motion-picture projectors available are examined, the different types of training film and, more important, their value in terms of teaching and retention of the subject matter should be understood.

There is no doubt that where the presentation of movement is needed, motion-picture film is indispensable. The motion picture can also compress time, i.e. a process that in real time may take 30 minutes, can, by the skills of the director and film editor, be presented in a few minutes only.

Types of training film

Industrial training film–16mm

Many large industrial companies throughout the world have produced films designed to train employees at all levels on a specific subject. These films usually run 10-20 minutes. They are screened in projection theatres with a cinema-type atmosphere. While films like these have been produced by professional film makers who have made the film in close collaboration with an expert on the subject–there is no guarantee that the film will, in fact, teach. Like the documentary, it may give the viewer background information only. Film, by its very nature, is fleeting; it is impossible for the viewer to remember the detail of the first few minutes of a training film after seeing a whole 20-minute programme.

For this reason a more simplified type of training film is recommended. The subject is broken down into logical steps, each sequence running no longer than four or five minutes. In this way, the viewer receives the information a little at a time, with the possibility of pausing after each step and having a discussion with the expert. Even existing full-length training films can be presented in this manner, with a pause after each four or five minutes so that the information can be digested and retained.

Single-concept loop films

The development of 8mm motion-picture film (initially for the home movie maker) introduced a new use of film for industrial training. Recognizing that the details in a full-length film could not be retained, several training film-production houses produced simple motion pictures to train an individual or group in one aspect of a subject. Initially, that had been done by making a continuous loop of a few feet of film, for example, a close-up scene of a demonstration of the correct way to file a piece of metal with a hand file, and screening it on a 16mm projector. This one simple action could be shown continuously so that the viewer could see it repetitively and thus absorb the training.

A specially designed self-contained 8mm projector was produced by the Technicolor Company, incorporating built-in rear projection. The 8mm film loop was housed in a special endless-loop cassette, which obviated the need for threading. Many thousands of these 8mm loop machines were sold to industry throughout the industrialized countries. Extensive libraries covering a multitude of subjects on 8mm single-concept loop were set up both in Europe and the United States. Sadly, many thousands of these 8mm projectors now lie covered in dust, unused–for several reasons. There were mechanical problems with the early 8mm loop projectors. Some industrial trainers bought these machines at the time perhaps not so much because they felt that they could put them to good use for training, but because they were attracted by the novelty of the system.

The lesson to be learned is that any film-display system must be chosen carefully. No gadget or new device can replace a properly prepared training course that integrates the use of film with other elements, the most important being the training officer or lecturer. The 8mm single-concept loop films and projectors were silent–their use required the presence of the expert on the subject and on teaching notes. Nevertheless, many of these machines are still in use, and single-concept loops are available in the libraries of the production houses.

Motion-picture projectors

The 16mm projector

The 16mm projector is the motion-picture machine most widely used in training and education (see figure 35). A mass of subject matter on this projector is available from film libraries, and catalogues of the subjects can be obtained from these libraries on request.

Modern machines are equipped with very powerful quartz-halogen lamps capable of projecting very bright pictures. Most modern machines are

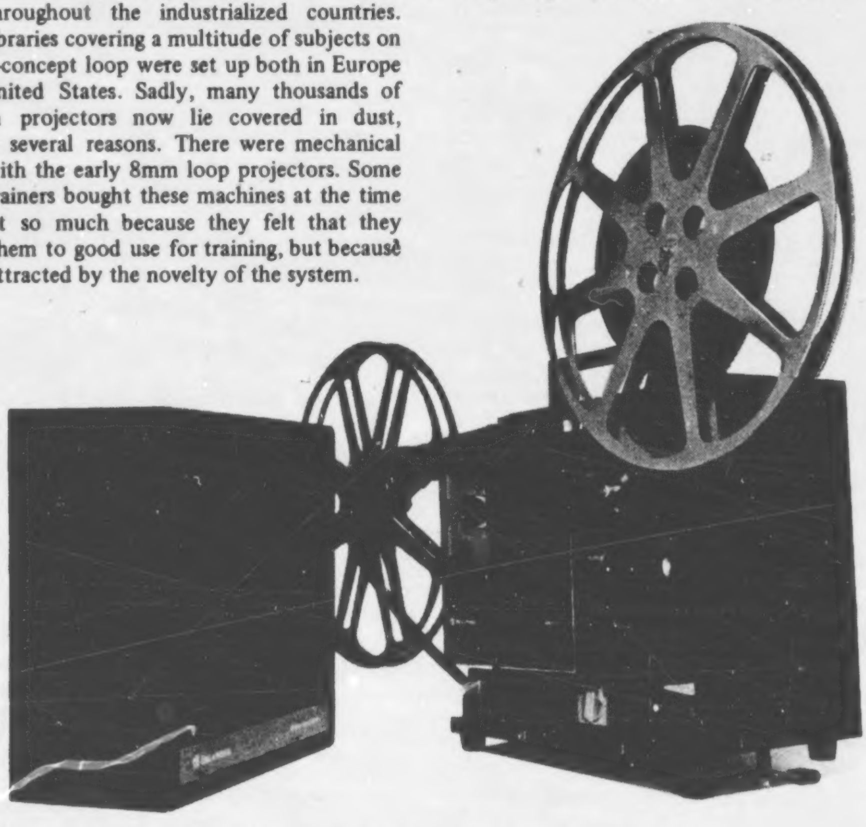


Figure 35. A 16mm Bell and Howell motion-picture projector

Courtesy of Bell and Howell

self-threading, it being necessary only to insert the leader of the film into the threading slot and from then on the machine threads the film through the picture and sound gates automatically. Various models can be obtained.

The standard type of projector is equipped to reproduce sound films carrying an optical sound track. Other machines will reproduce both optical and magnetic sound. Although most 16mm films from film libraries are printed with optical sound, in some cases magnetic sound reproduction is useful, although not essential. Magnetic sound reproduces at higher fidelity than optical sound. The most comprehensive type of 16mm projector is equipped with optical and magnetic sound reproduction and also has facilities for recording magnetic sound. This type of machine is recommended, since it is possible to record new commentaries on to existing films, in a different language. Figure 36 illustrates the layout and film path of a 16mm projector.

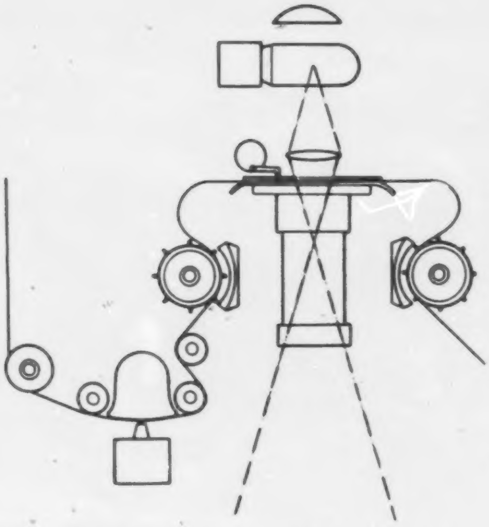


Figure 36. Layout and film path of a 16mm motion-picture projector

Modern machines will accept spools of 16mm film 400-1,600 ft in length with a maximum running time (at 24 frames per second) of 45 minutes. The same conditions for projection, as outlined in chapter VI (for slides), apply in general.

When using a 16mm projector, ensure that it is placed well to the back of the room and so arranged that the beam from the lens projecting the image cannot be obstructed by the heads of the viewers. Ensure that there is an extension speaker that matches the output of the projector amplifier, sited close to the screen. Although modern machines have built-in loudspeakers for the sound, without an extension speaker, they are suitable only for previewing a film in a small room. For the projection of sound films in a lecture room, the sound must come from the screen end of the room. The projector's built-in loudspeaker alone would mean that the sound would be heard from behind the audience and be of poor quality.

Ensure that the sound level from the screen speaker is at a sufficiently high level to be clearly heard by those at the back of the room, who will hear the noise of the projector much more than those in front of them. Try the film out before a show, listening to the sound from different parts of the room.

With modern 16mm projectors, an assistant can easily be trained to operate the machine. Instruction manuals are provided with the machines; they are very clear and are usually in several languages.

The decision on which kind of projector to buy will depend on funds available and the needs of the training manager. There are several manufacturers of 16mm sound projectors throughout the world. It is best to check with the nearest photographic retailer to find which makes are available. Give details of the local electric current supply when ordering. Whichever model is chosen, see that adequate supplies of spares and servicing and repair facilities are available locally.

Only simple maintenance is needed for modern 16mm projectors, which any non-skilled person can carry out. Precise information on maintenance is given in the instruction manual with each machine. Generally, it is a question of keeping the film path, as well as the sound head and the projector lens, clean.

The 8mm and Super 8mm projectors

The standard 8mm projector was developed originally for the amateur movie maker. In 1965, the Kodak Company introduced a new format for 8mm film, the Super 8mm film. It employs the same width as the old standard 8mm, but its rearrangement of the position and size of the sprocket holes gives a 50 per cent larger picture area per frame, which has increased the quality and definition of the projected picture enormously. Since then, apart from the adoption of this new format by the amateur, there have been rapid developments in the design and production of projection equipment for screening Super 8mm film. Most existing hardware manufacturers produce a Super 8mm version of the endless-loop, cassette-loading, rear-projection machine. New machines are available capable of presenting up to 20 minutes of programme from an endless-loop cassette, with sound and completely automatic. However, with several manufacturers, each making a different cassette to contain the film, a compatibility problem arises.

Since each company's machine has a specially designed cassette, only cassettes of that make can be used on the machine produced by that company. While that may be perfectly acceptable in organizations using only their own programmes, beyond such use, interchange of software is impossible without having the Super 8mm film unloaded from one cassette and reloaded into the cassette of a different make of machine, a time-consuming and costly operation.

A few years ago, two major manufacturers introduced a new type of cassette, not of the endless-loop type, but simply a plastic container for a reel of Super 8mm film. This cassette was designed to fit on to a new type of projector that automatically threaded the film from the cassette to the take-up reel. Some machines automatically rewound the film at the end of the reel. With few exceptions, these new cassette projectors were designed for front projection only. The two standards of cassette of the reel-to-reel type have been established by the Kodak Company for one type, and Bell and Howell for the other. One type is, unfortunately, not interchangeable with the other; it would have been far more sensible for these two large corporations to have agreed upon a standard cassette and projector auto-thread to create international compatibility.

Therefore, while several interesting Super 8mm endless-loop machines with built-in rear-projection screens are on the market, before deciding to acquire one, careful consideration should be given to:

(a) The problem of cassette non-compatibility between the various makes;

(b) The special equipment and skills required to load a film into any endless-loop cassette, which the normal visual aids unit personnel will not have. In industrialized countries, the film is always loaded either by a specialized film laboratory or by the main distributors for the particular make of machine.

Nevertheless, the Super 8mm projector is an inexpensive and highly portable machine for presenting silent films. There is a choice between modern reel-to-reel Super 8mm sound machines, which, while not being of the cassette-loading type, will thread the film automatically through the picture film path on to the take-up spool. Several companies produce this type of machine and also projectors of this type capable not only of reproducing the magnetic sound track carried on the edge of the film, but also of recording sound on to this track, known as a "magnetic stripe".

Similarly, the new machines accepting the Kodak and Bell and Howell reel-to-reel cassettes can be supplied with magnetic sound record/replay facilities. This type of Super 8mm projector is recommended because the film is always protected from dust by the cassette; and there is much less risk of mechanical damage, since the whole threading operation is automatic. These machines are simple to operate—even for a child. Most modern Super 8mm projectors can be supplied with zoom projection lenses as standard.

Although several film libraries have made some of their titles available in Super 8mm form, there has not been, unfortunately, a significant quantity of titles of up-to-date sound programmes in this form, the preference remaining for 16mm prints. This is a curious state of affairs, since Super 8mm colour prints cost less than half that of an equivalent length of 16mm; and modern Super 8mm projectors are capable of projecting a large, brightly illuminated image, only slightly less well defined than a 16mm image. Educational institutions, industry and commerce in the industrialized world are much more interested in the new electronic video-cassette system—yet these systems cost at least six or seven times the amount of a good Super 8mm cassette projector.

Regardless of the availability of training films in the Super 8mm format, a Super 8mm sound projector with recording facilities together with a Super 8mm film camera can form a very useful tool for industrial training when local subjects involving movement need to be presented. Super 8mm equipment is shown in figure 37a-e. With this equipment, simple subjects or single-concept material can be filmed in motion.

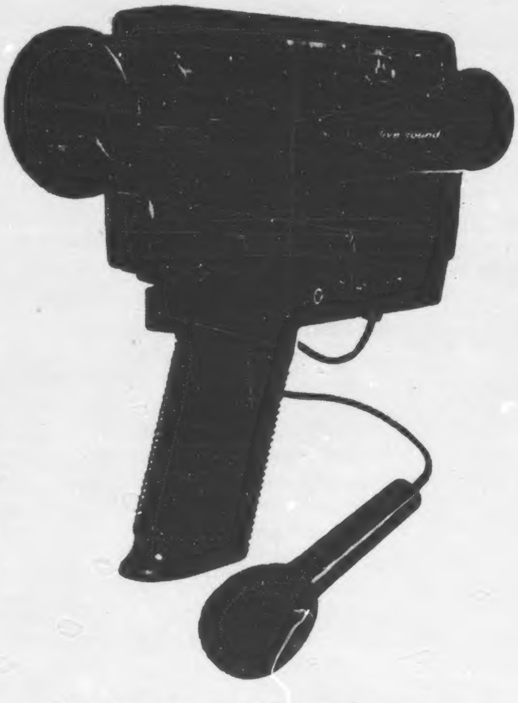


Figure 37a. Super 8mm sound camera

Courtesy of Eumig, Austria

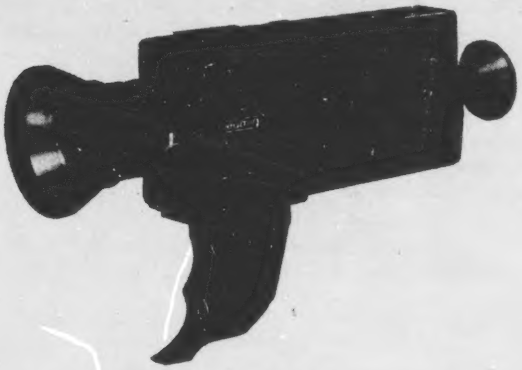


Figure 37b. Super 8mm silent camera

Courtesy of Eumig, Austria

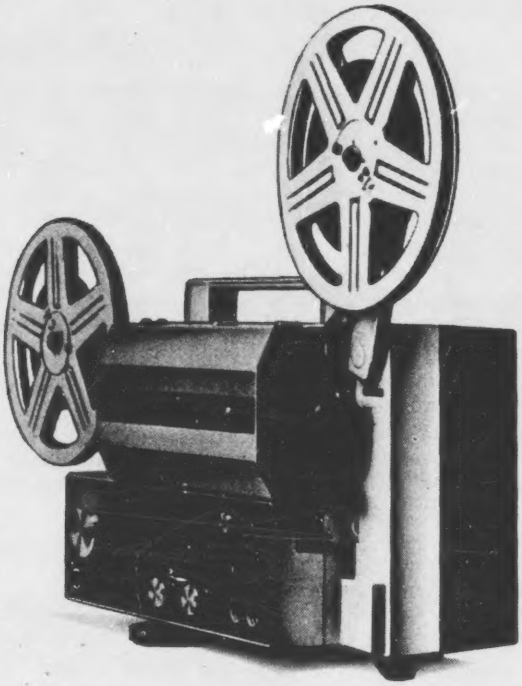


Figure 37d. Super 8mm sound projector

Courtesy of Eumig, Austria

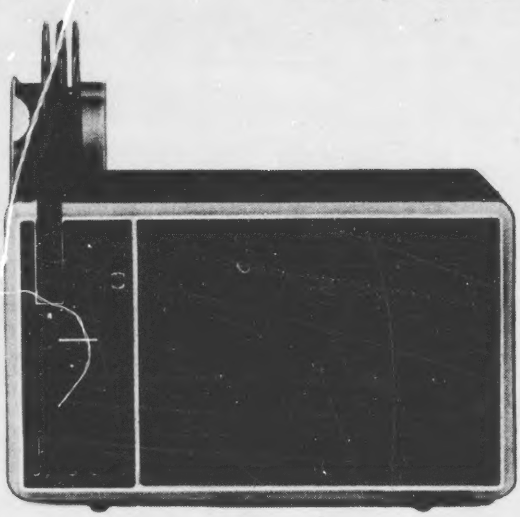


Figure 37c. Super 8mm/standard 8mm automatic threading rear projector

Courtesy of Eumig, Austria

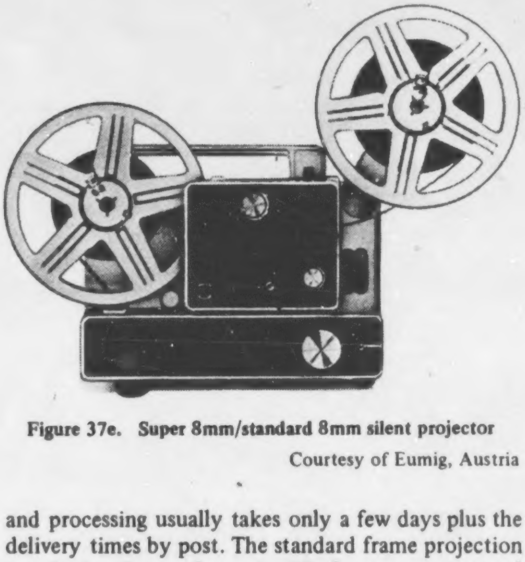


Figure 37e. Super 8mm/standard 8mm silent projector

Courtesy of Eumig, Austria

There are many makes of Super 8mm cameras to choose from–simple, inexpensive cameras requiring no particular skill on the part of the user and sophisticated cameras with zoom lenses and capability of macro-photography (the photography of small objects in large close-up). All makes accept a standard Super 8mm film cartridge containing 50 ft of unexposed film. The cameras need no threading–the cartridge is simply dropped into the film chamber in the camera and the equipment is ready for use. Modern Super 8mm film cameras are also equipped with automatic exposure systems, and a notch in the cartridge of film automatically sets the system to the correct exposure setting. Different emulsion speeds are taken care of by the notches in the cartridge.

Throughout the world, there are processing stations for the most widely used Super 8mm reversal-type colour film–Kodachrome II. The cost of processing is usually included in the price of the cartridge of film, and processing usually takes only a few days plus the delivery times by post. The standard frame projection speed for Super 8mm is 18 frames per second compared with 24 frames per second for 16mm. However, most Super 8mm cameras and projectors will run at 24 frames per second if required.

Once it has been decided which equipment is to be purchased–and the decision will depend on funds available and the work to be done–the Super 8mm system can be used for training. At this stage it should be recognized that film production is a skill requiring professional expertise; and, therefore, no attempt should be made to "make a movie" in the training context. Rather, the camera can be used for filming simple operations that will be useful for presentation as a part of a teaching programme, where the subject calls for movement. For example, it is easy to film a scene of an operator using a lathe. Close-up detail should be shown, the action confined to one planned operation. Several scenes of the operator at work could be photographed from different angles, or perhaps the same action could be repeated over and over while the camera is running the full 50 ft (15 m) of film, which at 18 frames per second will last for 3 minutes and 20 seconds.

When the processed film has been returned by the processing station, it will be on a 50 ft spool, ready for use. This spool will fit directly on to the ordinary reel-to-reel projector or in the case of the Kodak or Bell and Howell cassette machine, it is simply fitted into the 50 ft cassette and is then ready for projection automatically. The subject matter can then be integrated into the particular training lesson and the film sequence shown as a silent film, with the lecturer delivering the commentary on the spot; or, providing that magnetic striping facilities are available, the film can be "striped" and a commentary prerecorded, using the recording facilities on the projector. Silent film presentation will frequently suffice. Prerecorded films can be very useful for group training, since the trainees may review the programmes as often as they need in order to acquire information about new skills.

The usual precautions regarding local mains voltage should be taken before ordering this kind of projection equipment. The nearest local photographic dealer should be consulted as to the best available cameras and projectors. Ensure that there are adequate local servicing facilities. Make sure that at least two spare projection lamps are ordered with the projector. Power for Super 8mm cameras is derived from small batteries that fit into the camera, which is thus self-contained. A few spare sets of the correct type of batteries for the camera should also be ordered.

Titles[4]

The value of careful titling and of adequate diagrammatical explanations in film slides and film strips is not fully realized. Carefully made films deserve the extra attention that may convert them into a first-class production. A commentary, either spoken or embodied in a film, may be quite successful; but by providing a subconscious distraction for the audience, it may sometimes be less effective than purely visual explanations. The ideal is a proper balance of the two.

Titles, though essential when a personal lecture is not being given, should never be obvious; they should blend into the story to produce a smooth, uninterrupted flow of thought. Titles should be used only to explain something not obvious to the eye or to provide continuity between one scene and the next; they should never break into the story. Reference should not be made to scenes already past unless the scene is to be repeated, otherwise, the importance of the following scene will be lost in a flood of irrelevant thought.

The text should go straight to the point without the use of obscure or ambiguous words–simplicity should be the key-note. Except in the case of the main title, when several headings usually follow one another, a sequence of titles should be avoided. It may be unwise to include titles of a topical nature; these soon date the production and become uninteresting. A good title or caption should serve as a signpost only and should not attempt to repeat information or ideas that will be contained in the main body of the story.

Preparation of titles

Type style

The styles of lettering best suited to titles are those that are well spaced and bold in character. Extra bold, light or fancy type faces such as Old English and the Transitional Roman styles tend to become illegible and require much more time to read–these should be avoided. Type faces with a good body such as Helvetica Medium, Univers Bold, Grotesque 216, Gill Bold and Times Bold lend themselves particularly well for this purpose. Avoid the extra-condensed faces, since these are much more difficult to read. Once the style of type has been chosen, it is unwise to vary it. Varying styles are disturbing; a clear, consistent style conveys a sense of stability.

Hand lettering may be quite satisfactory but, unless well done, may appear crude. Those who are not adept at this type of work can produce effective hand-lettered titles with the help of various mechanical aids purchasable from most stationery outlets. Several methods are available that employ the dry transfer of letters from a type sheet, which will adhere to almost any smooth surface, for example, Letraset Instant Lettering. Yet another alternative is to use one of the many commercially made titling outfits that enable the user to produce titles quickly and with a minimum of trouble. As a general rule, titles produced on a typewriter do not look attractive, and if strongly contrasted against an unsuitable background, they can quickly induce viewing fatigue. Satisfactory results may be obtained with the more costly electric machines using carbon or plastic ribbons and the Varityper typewriter and IBM Composer have the advantage of interchangeable type faces.

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[4] The authors are grateful to the Kodak Company for permitting them to base their material on Kodak leaflet A/V3.

The above information can be considered most suitable for general titles. In some cases, depending on the type of subject, it may be more appropriate to use animated letters or other similar devices to indicate beforehand the nature of the story.

Composition

When composing titles, write the message first without any thought of final form; all the information that the title is to contain should be included. Random thoughts as to the feeling or emotions that the title may evoke may also prove useful. Without weakening or altering the intended message, go over what has been written with a view to deleting any material that might be considered superfluous. Once this has been done, consider substituting more concise and appropriate words that will convey the message. Do not overlook the power of suggestion that may be contained in only one word.

When the title has been stated as simply and effectively as possible, compare it with the original draft to see whether any important feature has been omitted. It is a good idea to read it aloud to get the feeling or timing. It should roll off the tongue easily and naturally and should fit well within the time allotted for its screen presentation.

The number of words per line and the number of lines per frame depend on the type face and the size of type; these depend in turn on the number of words to be included in each frame. To a lesser extent, the size of the projected picture and its brightness also influence the number of words per frame. Ideally, the frame should not contain more than six lines of more than four words of average length per line. However, when more words per frame must be included, these figures can be doubled. Long titles requiring a small size of type become tedious to read and should be avoided. Single-line titles should be positioned slightly high in the frame, the base of the letters standing on the centre line. This position commands attention and, at the same time, prevents the screen from appearing unbalanced. A formally balanced title is one that occupies a central position on the screen, and any misalignment or off-centre position is quickly noticed. The addition of a coloured band when using colour films, or one of greater density when using monochrome films, down one side of the background will render off-centre errors less noticeable. Use of an informal title–one that may contain cartoon or animated subjects or lettering–also makes framing errors less evident.

The dash can be used to vary the sense of motion. For example, the sentence "The blade revolves clockwise" tells one thing only, concisely and clearly. The audience knows what is happening at the precise moment and will subconsciously expect the next scene to be totally different. If the same sentence were to be written so: "The blade revolves clockwise–" the sense of motion is carried on and the audience will expect further information on the same subject. The latter sentence could be followed by: "–and comes to rest point downwards". The motion is then complete and the continuity broken.

Background

The choice of background, like the type style and the composition of the title, is directly influenced by the subject. A bright, flowery background is obviously unsuitable for a production on engines, and likewise an angular background would hardly be in keeping with a story on rural life.

For productions on science, architecture, handicrafts and similar technical subjects, the background is best kept to a mid-grey tone. An unobtrusive geometric pattern may help to fill the frame and enhance the mood. For subjects of a softer nature, a more delicate pattern can be used to advantage. The shadow of a branch and leaves on a background of a whitewashed garden wall has an association appropriate to a subject dealing with nature. Whether the background is intended for still or cine presentation, the variety of materials for construction is virtually unlimited. Really good titling depends on the ability of the photographer to choose the appropriate material.

As a general rule, the background of a title should not be brighter than a light grey. A large expanse of bright screen can be a strain on the eyes and may make the next scene appear too dark.

Photographic enlargements can well be used for pictorial backgrounds, the letters being stuck either on the face of the photograph or supported in front of it. For best reproduction, continuous-tone enlargements should be rather flat in contrast, whereas line photographs should be of high contrast.

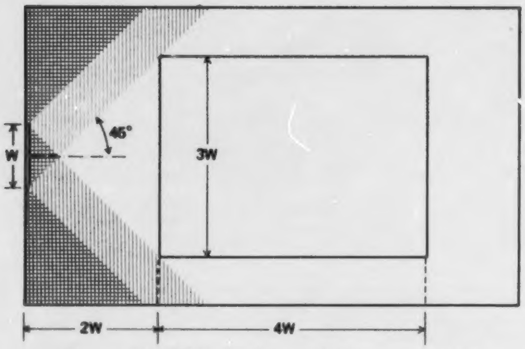
Very good backgrounds can be made from such materials as wallpaper, metal foil, grained wood and fine coloured powder. A quite effective method of obtaining a "live" background is to stick cut-out letters on a sheet of good-quality glass, which can then be photographed out-of-doors or on location in such a way that a part of the scene is shown through the glass. For the background to remain in sharp focus, it must be limited in its distance from the camera; the action must be confined within the depth-of-field when the lens is focused on the title lettering. Often, a more pleasing effect is obtained if the background is placed some distance behind so that it will be sufficiently out of focus not to detract from the importance of the lettering.

Legibility

Much has been said already that bears directly on the legibility and understanding of the projected title, but it may be useful to re-emphasize certain points. Some of the factors influencing legibility are: method of screen presentation, brightness, contrast and colour of the screen image, and actual viewing time. The influence of commercial advertising in television and the cinema has possibly drawn attention to the problems of legibility of films containing several titles and printed matter. A successful film means time and money saved, a prime consideration, which makes legibility particularly important. Titles and annotations are usually in upper case (capital letters), since these take up less room than the equivalent in upper and lower case. A minimum standard for the height of lettering of 1/36 of the height of the screen image will ensure good legibility at normal viewing distances.

Thought should be given to the manner in which the film is presented. The seating arrangement in the lecture room or theatre should be such that the whole audience can see the screen easily. The use of too great an angle of projection or too large an image size, in relation to the viewing distance, will almost certainly induce viewing fatigue and may cause eye strain. Usually, the maximum angle of lateral scan the viewer should have to make is approximately 30° from a normal central position (one exception to this is in wide-screen presentation). Further, certain legibility errors due to acute obliquity can occur at viewing angles of over 45° from a normal central position. The effect of this on the viewer is that the words of a normal title will tend to converge at the edges (see figure 38).

Legibility of a coloured title will depend to a great extent on the contrast of the colours used, or, in monochrome work, on the contrast between grey tones. A mixture of pastel shades does not reproduce well either on colour or monochrome film and should be avoided. The darker and more saturated colours are generally very much better, especially if they are used in conjunction with colours of lighter tone. The final choice of the most suitable colours to be used will, of course, be governed by the subject matter. However, a simple rule that can be learned from nature itself is that if something is to be seen or is to attract attention, it must be different from its surroundings. Conversely, if something is to be less noticeable, it should be made more like its surroundings. Contrast emphasizes and similarity subdues.



The screen width (W) is accepted as a unit for the arrangement of the audience, within an area of 3W x 4W.

Figure 38. The screen width for title photography

Courtesy of Philips

Sometimes the effect of an otherwise good title can be destroyed during projection by allowing too much stray light from the projector (or other light sources) to fall upon the screen. This results in a desaturation of the screen image. Thus, care should be taken to ensure that extraneous light shall be kept to an acceptable level. The question of the most appropriate type face for a title has already been discussed. However, for titles in colour, a factor that can influence considerably the legibility of the title, is the combined effect of type face and background colour. Suitable colour combinations are shown below:

Black	on yellow
Dark red	on light yellow
White	on orange
White	on red
White	on blue
Yellow	on black
Green	on grey (or white)
Blue	on grey (or white)
Black	on grey (or white)

If the light output of the projector is low or the level of ambient light in the room used for projection is high, white may be preferred to grey for a background.

Titles in monochrome and colour

If the production is in colour, the titles will obviously need to be in colour also. In general, what has been said of black-and-white title making applies to colour work also, except that the tone contrast of the black-and-white image is replaced by colour contrast.

The selection of the colours for individual titles is entirely a matter of personal choice and the cultural background of the audience, but the colours must harmonize with the atmosphere of the subject. For instance, a story on boxing would look ridiculous with titles in pale pink on a delicate blue background, whereas this combination of colours would be ideally suited to a story on spring blossoms.

High and low colour contrast will have a vastly different effect on an audience. A bright yellow on a dark-green background gives a high colour contrast and will command attention. A pale pink on a yellow background gives a low colour contrast, and will convey a feeling of delicacy and lightness. The list below is representative of key colours with the corresponding feelings or ideas they may suggest to Western minds.

Dark red	Fire–heat–blood–danger
Light red	Warmth–life–fun
Pink	Delicacy–sugar–youth
Orange	Party–sweetness–summer
Brown	Indoors–animals–farming
Dark yellow	Autumn–closeness–attention
Light yellow	Clean–brilliancy–lightness
Dark green	Woods–depth–peace
Light green	Spring–fields–games
Purple	Age–heaviness–mystery
Dark blue	Silence–infinity–night
Light blue	Evening–winter–smoothness

Photographing titles

Setting up

When setting up the camera for titling, it is most important that the camera and easel be perfectly level, square to the copy and centred accurately. A line of type that unintentionally runs downhill or is off-centre creates a very unfavourable impression on an audience. The effect can be overcome to a certain extent by providing a means of centring the title card so that errors of this nature are rendered less noticeable. A copying stand or titler (either horizontal or vertical) is a valuable aid.

A small pocket-torch bulb and battery can be useful in positioning the type-matter accurately. On some cine cameras, the pressure plate can be easily removed, permitting free access to the aperture plate. If the lighted torch bulb is then held in the gate directly behind the lens, the outline of the picture area will be projected on to the easel. The corners and centre point of this area can be lightly marked. If, then, the title is placed centrally in this area, it will appear accurately positioned on the film.

Most 16mm cine cameras used for preparing titles should be of the reflex focusing type, since they simplify focusing and correct alignment. With other types, it is best to do the focusing and framing at the film plane, if possible.

Care should be taken in both still and cine work to avoid reflections from shiny or polished parts of the copying equipment. This precaution is especially important when the matter to be copied is held under glass. All parts of the copying stand should be painted with a matt black paint. If necessary, a sheet of matt black paper should be placed immediately in front of the camera; a small hole should be allowed for the camera lens to protrude through. Additionally, care should be taken to check the evenness of illumination (see figure 39) and the magnification and focusing. A slightly "fuzzy" image, magnified many times, can spoil an otherwise perfect picture.

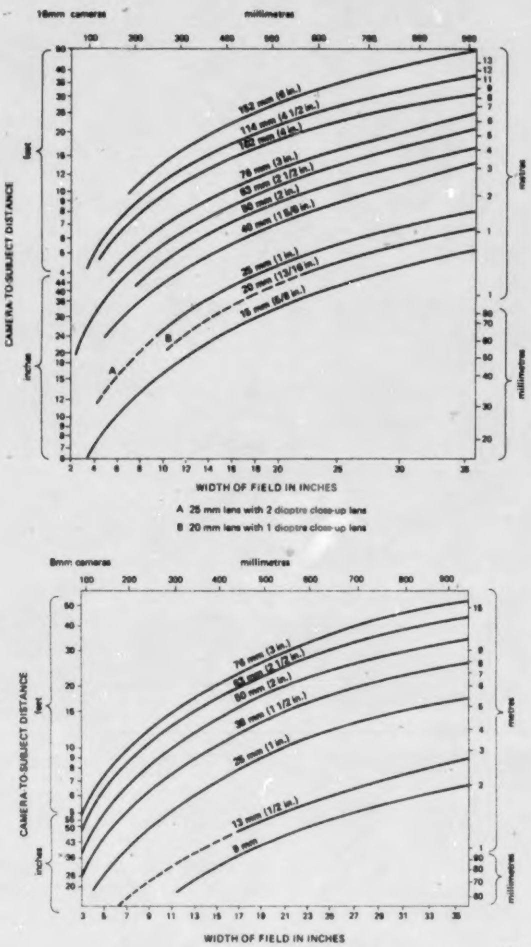


Figure 39. Camera-to-subject distances with various lenses

Courtesy of Kodak

Use of supplementary lenses

The use of supplementary lenses enables photographs to be taken with still or cine cameras of small models, flowers, insects, coins, or any small object to be used as background material. Such objects can produce greater realism in animation work and added interest.

In close-up photography, the depth of field is extremely small if shooting at large apertures; the portion of the picture in sharp focus may extend only a few millimetres on each side of the plane of focus.

When using supplementary lenses, it is advisable to employ the smallest lens aperture practical, which will help to increase the depth of field and reduce to an acceptable level any aberrations that may be introduced into the optical system by using these lenses. A lens aperture not larger than f/8 should be used on a 16mm cine camera, or f/5.6 with 8mm cine cameras.

Where the camera has interchangeable lenses, extension tubes may be used instead of close-up lenses. These act as a spacer, increasing the lens-to-film distance. The use of extension tubes is often preferred to the use of close-up lenses, since they do not introduce any further lens aberrations. Unlike close-up lenses, however, the use of extension tubes requires an increase in exposure dependent on the degree of reduction (that is, the ratio of image to object size). Factors for a range of image-object ratios are given below. The exposure measured or calculated for a lens setting at infinity should be multiplied by the factor corresponding to the reduction ratio used.

Reduction ratio	*Factor*
1:20	1.10
1:19	1.11
1:18	1.12
1:17	1.12
1:16	1.13
1:15	1.14
1:14	1.15
1:13	1.16
1:12	1.17
1:11	1.19
1:10	1.21
1:9	1.24
1:8	1.27
1:7	1.31
1:6	1.36
1:5	1.44
1:4.5	1.50
1:4	1.56
1:3.5	1.65
1:3	1.78
1:2.75	1.86
1:2.5	1.96
1:2.25	2.09
1:2	2.25
1:1.75	2.47
1:1.5	2.73
1:1.25	3.24
1:1	4.0

Timing

The time a title is actually on the screen is important. Enough time must be given for the audience to read it before the next scene appears, while a title that remains on the screen too long becomes tedious. An allowance of five seconds for the first four words, and half a second for each additional word of more than three letters forms a good working basis. This formula holds good for average titles of not more than four lines. Longer titles should be read through at normal speed, then the first half read through again. This procedure will ensure that even the slowest reader will have time to understand the title without its becoming boring to others.

The type of audience to which the film is to be shown should be taken into account when timing a title, as children and young persons require a longer time to read than most adults. The question of timing also plays an important part in the presentation of films containing detailed maps, charts or diagrams. The main point to keep in mind is that the scene length should be varied to avoid monotony. To assist in the planning of correct timing the table on page 61 may be used.

Exposure

Many of the films that are used for making titles or diagrams are of the reversal type, and with these films accurate exposure is important, particularly so when colour reversal films are used, since a small deviation from correct exposure may upset the colour quality of the projected image considerably. It is advisable to use a photoelectric exposure meter to obtain consistent results. Owing to the varied and unusual lighting conditions that are often encountered, it is impossible to give specific exposure recommendations.

Lighting

Particular care should be taken in placing the lights to avoid reflections from the copy, the copy stand or the lights themselves. If care is not taken, the resulting image may not only be seriously degraded but, in certain circumstances, can be completely obliterated.

Two factors affecting lighting control are:

(a) Reflections of the lights into the camera lens by the copy itself, especially if the copy has an uneven, creased or curved surface;

(b) Light reflected by the copy or its surroundings, striking the front of the camera and causing an image of the camera to appear on the copy, mostly noticeable when photographing glossy or glass-covered originals.

Reflections of the first type can sometimes be avoided by placing the lights outside the reflection angle of the lens (see figure 40). A further method is to apply a matt lacquer or a specially prepared anti-reflection compound to the copy.

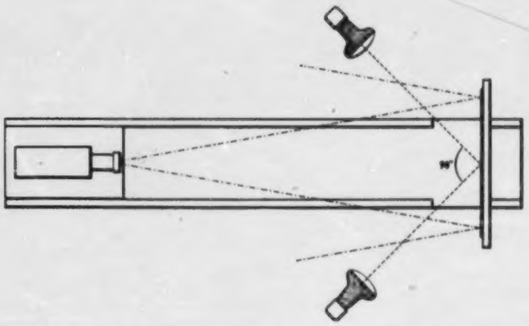
Reflections of the second type can often be eliminated by painting the copying stand with matt black paint, by masking with black paper any white or highly polished areas that fall within the field of view of the camera or by covering the front of the camera, except for the lens, with black card or paper. The area immediately within the vicinity of the camera and copying easel should also be darkened.

The precautions described above are particularly pertinent when colour films are used, since the inclusion of unwanted reflections in the subject area covered by the camera not only produces undesirable

RUNNING TIMES AND FILM LENGTHS FOR COMMON FILM FORMATS AND PROJECTION SPEEDS
(Film length in feet + frames)

		8mm (80 frames per foot)		*Super 8mm (72 frames per foot)*		*16mm (40 frames per foot)*		
		18 fps	*24 fps*	*18 fps*	*24 fps*	*16 fps*	*18 fps*[a]	*24 fps*
Seconds	1	0 + 18	0 + 24	0 + 18	0 + 24	0 + 16	0 + 18	0 + 24
	2	0 + 36	0 + 48	0 + 36	0 + 48	0 + 32	0 + 36	1 + 8
	3	0 + 54	0 + 72	0 + 54	1 + 0	1 + 8	1 + 14	1 + 32
	4	0 + 72	1 + 16	1 + 0	1 + 24	1 + 24	1 + 32	2 + 16
	5	1 + 10	1 + 40	1 + 18	1 + 48	2 + 0	2 + 10	3 + 0
	6	1 + 28	1 + 64	1 + 36	2 + 0	2 + 16	2 + 28	3 + 24
	7	1 + 46	2 + 8	1 + 54	2 + 24	2 + 32	3 + 6	4 + 8
	8	1 + 64	2 + 32	2 + 0	2 + 48	3 + 8	3 + 24	4 + 32
	9	2 + 2	2 + 56	2 + 18	3 + 0	3 + 24	4 + 2	5 + 16
	10	2 + 20	3 + 0	2 + 36	3 + 24	4 + 0	4 + 20	6 + 0
	20	4 + 40	6 + 0	5 + 0	6 + 48	8 + 0	9 + 0	12 + 0
	30	6 + 60	9 + 0	7 + 36	10 + 0	12 + 0	13 + 20	18 + 0
	40	9 + 0	12 + 0	10 + 0	13 + 24	16 + 0	18 + 0	24 + 0
	50	11 + 20	15 + 0	12 + 36	16 + 48	20 + 0	22 + 20	30 + 0
Minutes	1	13 + 40	18 + 0	15 + 0	20 + 0	24 + 0	27 + 0	36 + 0
	2	27 + 0	36 + 0	30 + 0	40 + 0	48 + 0	54 + 0	72 + 0
	3	40 + 40	54 + 0	45 + 0	60 + 0	72 + 0	81 + 0	108 + 0
	4	54 + 0	72 + 0	60 + 0	80 + 0	96 + 0	108 + 0	144 + 0
	5	67 + 40	90 + 0	75 + 0	100 + 0	120 + 0	135 + 0	180 + 0
	6	81 + 0	108 + 0	90 + 0	120 + 0	144 + 0	162 + 0	216 + 0
	7	94 + 40	126 + 0	105 + 0	140 + 0	168 + 0	189 + 0	252 + 0
	8	108 + 0	144 + 0	120 + 0	160 + 0	192 + 0	216 + 0	288 + 0
	9	121 + 40	162 + 0	135 + 0	180 + 0	216 + 0	243 + 0	324 + 0
	10	135 + 0	180 + 0	150 + 0	200 + 0	240 + 0	270 + 0	360 + 0

[a] 18 frames per second is the standard running speed for 16mm film with magnetic sound track; this is so close to the standard silent film speed of 16 fps that on modern equipment 18 fps tends to be used for both silent and magnetic track films.



This diagram shows the best position for the lights when photographing flat copy. The lights are forward of the camera lens and equally spaced for even illumination. If glass or other glazed materials are used at the easel, the lamps must be outside the reflection angle of the lens (as indicated by the dotted lines), to prevent the glare of the lamps from reflecting into the camera lens.

Figure 40. The position of lights for photography

Courtesy of Kodak

"ghost" images of the various parts of the copying equipment, but also reduces colour saturation. Certain screens, when used over the camera lens and with suitable polarizing sheet material over the lamps, afford complete control of all reflections.

Two No. 1 or No. 2 reflector photoflood lamps comprise an ideal lighting set-up for titling etc. The lamps should be placed equidistant from the title board on either side of the camera. When using a very high-speed material such as Tri-X reversal film, it may be found more convenient to use two 150 watt reflector lamps at about 2 ft (0.6 m) instead of the photoflood lamps at 3 ft (1 m). The choice will depend to some extent on the size of the original to be illuminated. Except for deliberate lighting effects, which are discussed in greater detail below, even lighting is essential. The evenness of the light can be checked with an incident-light meter. Alternatively, an opaque ruler can be placed against the copy, parallel to the lens-easel axis and the evenness of the shadows produced on either side observed.

Photoflood lamps tend to darken with age, and their output then drops considerably. As soon as any darkening is noticed, both lamps should be replaced with new ones; otherwise, unbalanced illumination may result.

The colour temperature of the light changes with the voltage applied to the lamps. To ensure consistent colour rendering when producing a series of titles by tungsten lighting, the voltage must be adequate and stable. Minor fluctuations in voltage have a pronounced effect on colour balance. With a 3,200 K flood lamp on 240 volts, colour temperature will be lowered to 3,092 K by a drop of 20 volts. On a 110-volt system, the same drop in colour temperature is brought about by a drop of only 9 volts.

Fluctuations in voltage also affect the output of tungsten lamps, roughly as the fourth power of the voltage. For example, a drop of 40 volts from a 250-volt supply can halve the lamp output and double the required exposure. To avoid colour changes, when a variable light source is required, the lamp-to-subject distance should be altered. A voltage stabilizer therefore is also essential to avoid a changing output.

Special effects

Numerous and varied effects are possible in title making. A feeling of depth can be produced by using three-dimensional title letters illuminated by a single spotlight placed obliquely to the easel.

The use of a short focal length lens may give rise to perspective distortion (obliquity); this effect becomes apparent when rather long titles are used. As the angle of view increases from the lens-axis, more of the edge of each letter can be seen. A longer focal length lens used at a slightly greater distance from the easel will usually correct the distortion.

Other methods of creating desired effects are:

(a) Coloured filter material can be placed over a spotlight to produce an effective blend of colours;

(b) The level of illumination of both the title and the background can be controlled independently by mounting the title letters on glass and placing the background at a convenient distance behind the title, say, 7-9 in. (18-23 cm) to give greater emphasis to the title;

(c) The use of black velvet as the background is especially effective in giving the appearance of titles suspended in a void;

(d) Coloured chalk can be used to produce titles quickly. The result is a rather pleasing casual "blackboard" style. Of course, this type of title is suitable only for informal presentation.

Special cine techniques

In cine titling, improvised fades can be made easily by slowly dimming the exposing lights by means of a variable resistance or by turning the lights away from the easel. However, the former method is not recommended when colour film is used, since the colour temperature changes and becomes warmer when the voltage is reduced. Fades can also be produced by using one of the following:

(a) A camera with a variable shutter;

(b) Subdued light, using the iris diaphragm to reduce the illumination (a lens without click stops is advised). This method is suitable only when filming at large apertures;

(c) A special fading glass, virtually a neutral-density wedge, in front of the camera lens;

(d) Two polarizing filters placed together in front of the camera lens with one of the filters being rotated until its axis of polarization is at right angles to that of the other;

(e) Self-adhesive fades and effects of various types, which are designed to be stuck on the film itself; these may be suitable if a cheap, quick system is required. They can, however, be safely run through some projectors only a certain number of times.

The dissolve is simply a superimposed fade-in and fade-out. It is best produced by making two (or more) rolls of edited film, known as A and B (etc.) rolls (see figure 41). The processing laboratory can then print these on one length of film in the correct sequence. Some laboratories will, if requested, do the entire editing; they must be given detailed instructions on the sequence and the effects required. If use of a laboratory is intended for other than straightforward processing and duplicating, the laboratory should be consulted before the shooting of the film.

Editing to make A and B rolls

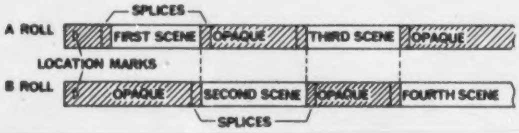


Figure 41. Editing 16mm A and B rolls

Courtesy of Kodak

If only the original is to be made, dissolves can be produced by using the lens diaphragm, the lights or a combination of both. The camera should be capable of reverse filming and have a single-frame exposure counter. A and B roll editing is also the most efficient way of ensuring that splices made in joining titles etc. to the film shall not be visible when projected after printing.

When the title is too long to be placed conveniently in one frame, the words can be printed on a long strip of paper and then pulled slowly up in front of the camera lens while the camera is running.

Diagrams, graphs and charts

Diagrams, graphs and charts should be simple, straightforward in style and bold in character. Diagrams are a convenient means of illustrating internal mechanisms, or cycles of operation; graphs and charts provide a most useful means of condensing data or facts and figures that would otherwise have to be explained in great detail and would thus be confusing to the audience (see figure 42).

In each case, the lines should be well spaced and bold in form, the complete illustration using as much of the format as possible. Annotations can be added

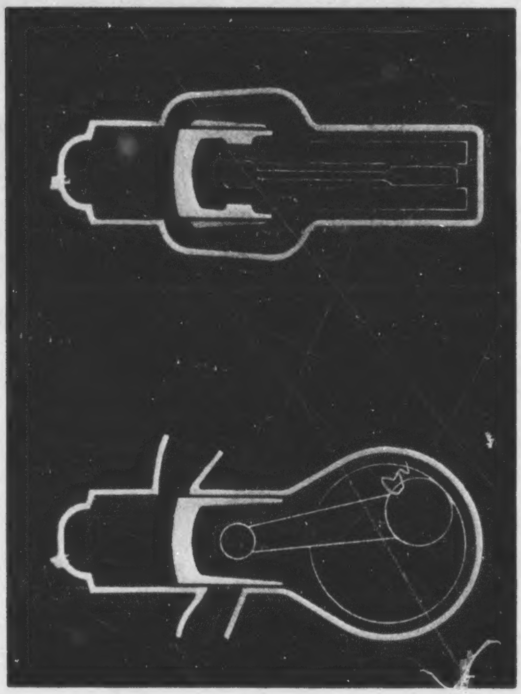


Figure 42. Diagram animation

Courtesy of S.B. Animation

as desired by covering the original artwork with, for example, a sheet of transparent acetate film, then sticking the lettering in position with rubber adhesive. If this method is used, the lights should be placed as close to the camera as possible without obtaining direct reflections into the lens from the surface of the film (see figure 40).

The projection should last long enough for the audience to understand the illustration fully. If the illustration is at all complicated, it may be repeated advantageously at a later stage, to add more force to the presentation and avoid misunderstanding. Black lines on a white background are quite suitable for this type of work, but care should be taken to prevent over-exposure. Indeed, slight under-exposure with reversal materials is an advantage, since it helps to prevent glare from a white screen. In most cases, it is better to use a good matt art paper and, except where chalks are used, the lines drawn with a draughtsman's ruling pen or a broad mapping pen.

Even when the fundamentals of making titles or films have been mastered, the aim should always be to tell the story in pictures only. The use of titles and illustrations will help the story where it becomes difficult to understand or when it is desired to emphasize a particular point. The following section on animation may provide further ideas on how the scope of producing illustrations can be very much widened.

Animation

The information contained in this section is primarily intended for those wishing to use film and having a suitable camera capable of making single-frame exposures. Animation, in the true sense of the word, is impossible with still slides, although some of the principles explained here may be applied.

The relatively large amount of preparation needed in large-scale animated productions often justifies the existence of special sections handling only such work as planning and artwork. With this set-up the photographer can devote his attention to the problems concerned with the practical side of filming.

Animation can make significant contributions to industrial films in many ways. It can show a complex situation such as the working structure of an industrial organization simply with diagrams; it can show how a machine functions when a live-action camera cannot photograph such an action from outside. It can also be used to superimpose over a live action, revealing what is happening inside a tool or machine. In fact animation, if used well, can clarify and simplify the information presented and thus promote quick understanding. It can also be used to establish symbolic relationships. For example, provided that it is explained beforehand, 100 or 1,000 can be represented. Such quantitative representation can save a great deal of time. It can also be used to advance an argument in the form of moving signs and symbols–the dollar sign can be converted into what it can buy, for example, three loaves of bread. This device (called a metamorphosis) can reveal quickly and visually certain points that would perhaps be less effective when put across verbally.

Among the techniques of animation, which is basically a handicraft operation, some have evolved during the past few years that can be manipulated by machine. Such possibilities include the video monitors, capable of providing a range of movements, and the capability of the computer to generate motion through its visual displays. It is inappropriate to list these new technologies in this manual, since even in the highly developed countries it is extremely difficult to come by the right sort of hardware in the right price range to make good use of them.

Equipment

As already explained, the camera most suitable for animation work should have a single-frame exposure device (see figure 43). Very small adjustments of the subject can then be recorded in such a way that when the final film is projected, the illusion of smooth and uninterrupted movement will appear. Giving short bursts of exposure on a camera not equipped for taking single-frame exposures is not recommended, and results obtained by this method certainly do not project satisfactorily.

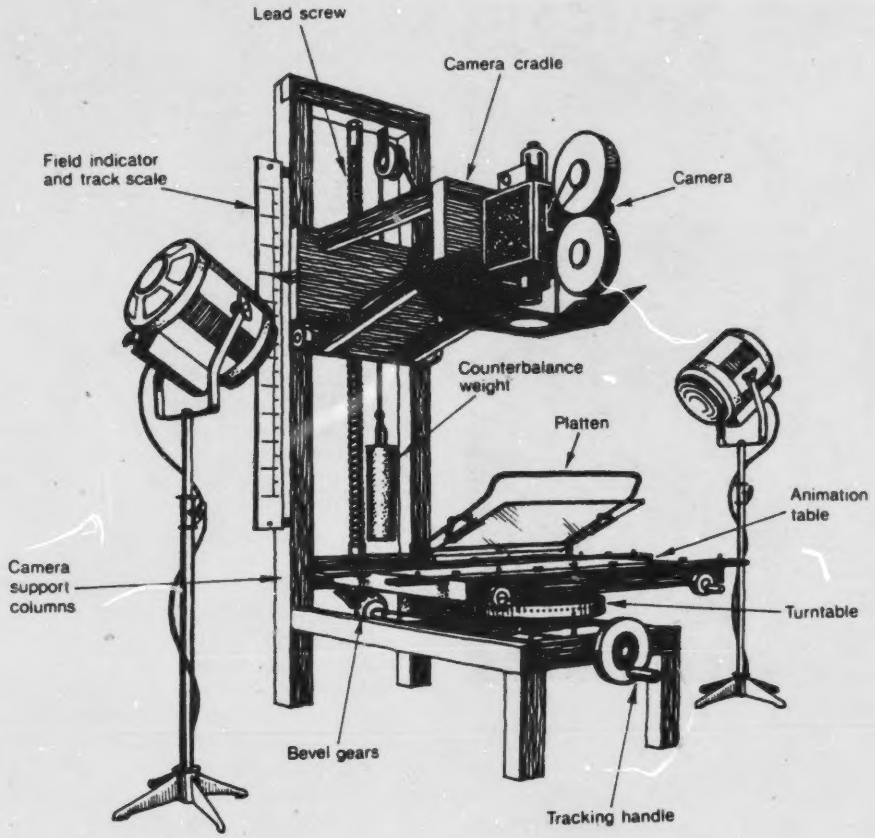


Figure 43. The 16mm animation camera with lights

Courtesy of Educational Film Centre, London

For accuracy, the single-frame exposure camera should give consistently uniform exposures from frame to frame. Unfortunately, many of the spring-wound cameras of this type do not meet this requirement. A further important feature affecting uniform exposure is the manner in which the shutter release is operated. Small inconsistencies can usually be overcome by employing an electrically operated release mechanism, i.e. a solenoid.

The camera should, if possible, be of the reflex-viewing type, since it permits very critical focusing when filming at the short distances encountered in most animation work. A titler, together with the correct supplementary lens, may be used instead of a reflex camera.

Additional camera features that are desirable if advanced work is to be carried out are:

(a) Camera backwind, which enables the film to be rewound in the camera for multiple exposure work;

(b) Variable shutter, which permits camera fades to be made; when it is used in conjunction with the backwind, the camera dissolves are good.

Certain aspects of animation work demand the use of an efficient, sturdy stand or support. This stand may conveniently be in the form of a modified horizontal or vertical plate enlarger with the lamp-house being replaced by the camera. This set-up facilitates the operation and permits very high quality to be obtained. For overlay work or where cell animation is to be used, an ordinary adjustable enlarging frame can be used with various directional corrections made by moving the frame on the easel.

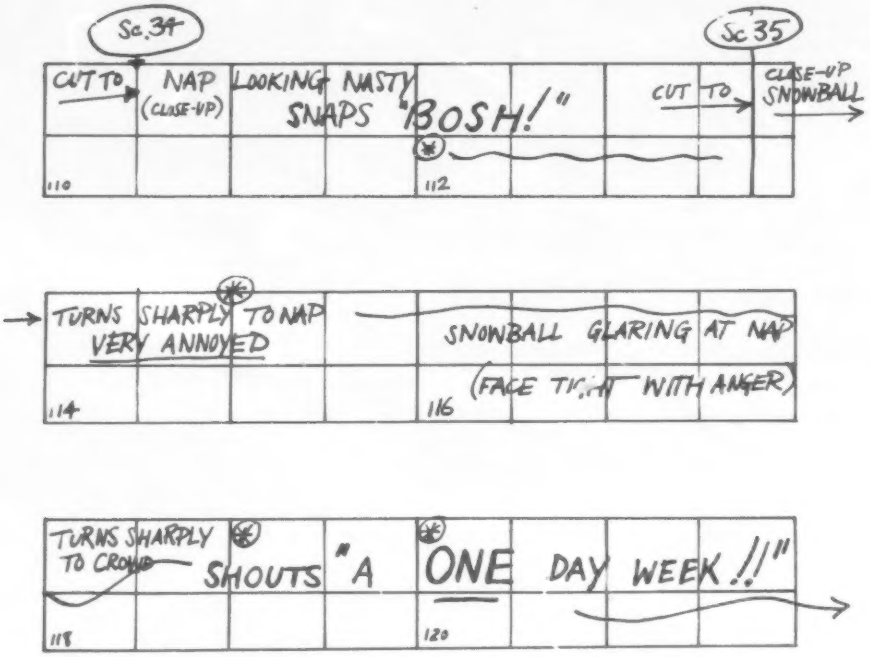
Two No. 2 photoflood lamps in suitable reflectors should provide sufficient illumination for most of the animation work. "Cell" animation is the dividing up of a scene into static and moving parts, each on a separate sheet, which, when put together in register, make up the whole scene, as shown in figure 46. It demands an even spread of light over the area to be filmed, and any direct light from the lamps must be prevented from falling on the lens. Accessories such as "barn doors", diffusers, and other reflectors or spotlights, permit greater flexibility and control of lighting.

Other items of equipment, such as a table with a built-in illuminator or a transparency illuminator, permit the rear illumination of transparencies. Rear illumination is particularly useful for superimposed-title work or for illuminating transparent coloured backgrounds.

An exposure meter is probably the most reliable means of determining exposures for animation filming, owing to the close proximity of the subject, lights and camera. However, care should be exercised in the use of the meter to avoid stray light reflected from lights, clothing or objects not in the scene. Possibly the most accurate method of determining exposure is to use the meter for reading the incident light. With this technique, readings should be taken at the cell surface, or at the position of the object being filmed, with the aperture of the meter facing the camera. In cell animation, the meter should be moved to several positions over the area to be photographed to check the uniformity of the lighting.

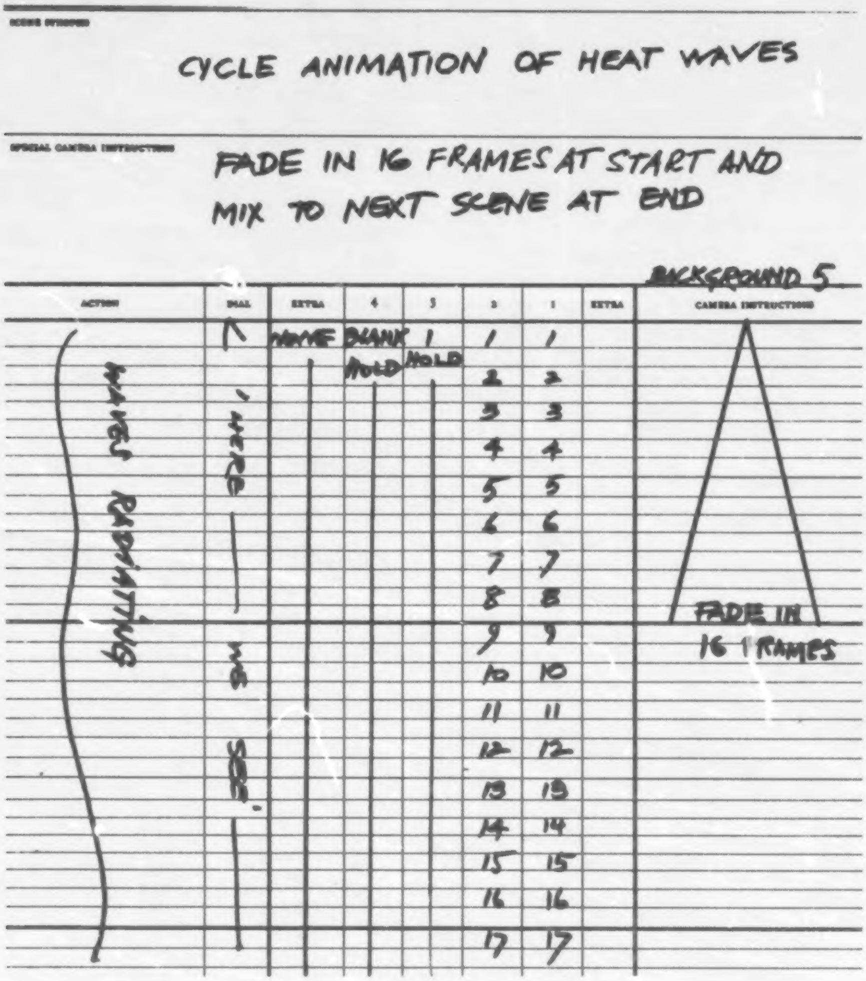
Types and methods of animation

The use of a timing sheet (see figures 44a and 44b) for animation work is extremely useful, since it enables a complete film to be worked out on paper and permits the timing of each scene to be gauged very accurately. The scene length and the content of the film can be altered slightly, which may make reshooting of a scene unnecessary. The layout of the timing sheet depends on the requirements of the film. Several columns representing each movement of the object, or frame number, are ruled on the sheet, which then tells at a glance the time allowed for each scene when in its final form. In addition, columns must be provided for the action of the story, dialogue (if any), background, special effects and camera instructions.



TIMING OF ACTION. The WORK BOOK defines the length of each slot; each square represents a half-second time unit.

Figure 44a. Sheet showing the timing of action



SCENE SYNOPSIS

CYCLE ANIMATION OF HEAT WAVES

SPECIAL CAMERA INSTRUCTIONS

FADE IN 16 FRAMES AT START AND
MIX TO NEXT SCENE AT END

BACKGROUND 5

ACTION	DIAL	EXTRA	4	3	2	1	EXTRA	CAMERA INSTRUCTIONS
WAVES RADIATING	HERE, — WE SEE.	WAVE	BLANK	1	1	1		FADE IN 16 FRAMES
			HOLD	HOLD				
					2	2		
					3	3		
					4	4		
					5	5		
					6	6		
					7	7		
					8	8		
					9	9		
					10	10		
					11	11		
					12	12		
					13	13		
					14	14		
					15	15		
					16	16		
					17	17		

Figure 44b. Animation camera chart

Animating three-dimensional objects

Animating a three-dimensional object frame by frame may be just as useful as giving movement to animated drawings. To show how an engine works step by step or how a factory is assembled according to a blueprint is possible right in front of one's eyes. This method, which need not be too difficult technically, permits the illusion of the three-dimensional look of an object in its round to be retained, and such an object can be turned about and manipulated in stages.

To achieve the required effect of inanimate objects moving mysteriously and seemingly by their own volition, some attention must be paid to such factors as the size, weight, shapes and colour of the object and the type of movement it is to perform. If the desired movement can be produced by continuous, instead of single-frame filming, a considerable saving in production time will be achieved, and the results may be smoother and more uniform. For example, if a rotating movement of the object is required, it is much easier to mount the object on a motor-driven turn-table and film continuously. If the object is to appear as if rotating in mid-air, the turn-table and the background can be covered with black velvet. However, if the rotation is to start and stop precisely and run for a given number of frames, then single-frame animation is the only answer. The technique of using reverse-action filming can be applied quite successfully here to allow the object to come to rest at a specific point. The success of the final film will largely depend on how well it has been prepared, and trial exposures may be necessary.

A camera fitted with a zoom lens may be used to bring greater emphasis to one part of the rotating object, especially if the lens is zoomed while filming. A somewhat similar effect may be achieved without using a zoom lens, by taking the same film sequence with single-frame exposures, gradually moving the camera towards the object between each exposure and refocusing each time. If this is attempted, extreme care should be taken to ensure that the image is always kept in the same relative position at the film plane.

The main advantage of making animated films by single-frame exposures is that it clarifies obscure and complex movements of the subject. The number of frames necessary to complete the action should be determined before filming commences. The timing sheet (see figures 44a and 44b) is particularly useful here. It also forms a record of the pattern of movement of the subject and may, should an accident occur during filming, be the only way in which a scene can be accurately duplicated. However, it should be remembered that once the subject has been moved, it is almost impossible to relocate it exactly as it was before.

Light objects may be fixed in their various positions by the use of modelling clay, balsa cement or other such fixatives. For heavy objects, the use of mounting brackets is recommended. Alternatively, the object may be placed on a sheet of glass. Glass can also be used to achieve a number of effects, one of which is to place the object on the glass sheet to give the impression of its being suspended in mid-air. Sometimes movements of the object can be simulated by making small shifts in the camera position.

Animating graphs, charts and maps

Another simple and effective type of animation is that applied to graphs, charts and maps, for example, moving lines that seem to draw themselves, routes on maps that appear to trace themselves from point to point and arrows that move in and point to some salient feature of a drawing or scene. An advantage of this type of animation is that the movement captures the viewer's attention and thus permits a point to be emphasized. In industrial films, complex information can be presented in a simplified manner by using animated sequences.

The most convenient way of producing such animated sequences is to place a sheet of glass or clear acetate material over the original to be filmed and to ink-in, one segment at a time, the required lines. Single-frame exposures of the scene must be made before the next segment is added. Should the line be complex in shape or direction, a better method is to use the reverse-action filming technique.[5] Here the material is placed on the animation stand inverted relative to the camera position. The line is then drawn in completely on the sheet of acetate. Water-soluble ink or paint, or wax crayon, is the ideal medium for making the annotations, since these can readily be erased when required. To animate the line, small portions of it are wiped away with a damp cloth or suitable eraser, since the procedure is recorded one frame at a time. Turning the film right-side up for projection reverses the action and causes the line to draw itself.

A most useful tool to carry out such work is over a specially built light-box that can be constructed out of simple material (see figure 45). Another essential tool is a peg-bar, which keeps the drawings and celluloids in proper register.

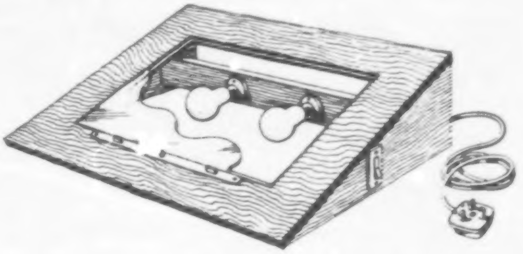


Figure 45. Animation light-box

Courtesy of Educational Film Centre, London

Cell animation

The value of using celluloid (transparent sheets of plastic material) is due to economics and convenience. The animated drawings can be traced on cells and painted in colour or tone. Each moving figure or object has a series of cells to itself, so that one figure can remain still while another is moving. A figure also may move at different rates. It is likewise possible to hold any part of a body still while the limbs of a figure animate on a separate layer of cell. A further advantage of using celluloid is that it is practically transparent and reveals the background clearly behind the painted figures and objects, provided that not more than four layers are used in any scene (see figure 46).

Cell animation must be carefully prepared. Films lasting for only 10 minutes may require over 7,000 separate drawings to achieve a high degree of continuity of movement. Therefore, in view of the amount of time and material likely to be used, the production of cell-animated films can be costly.

Cell animation demands the use of a stand that will permit accurate alignment of each cell. Where cells are produced on acetate sheet or clear plastic material, an illuminated opal screen may conveniently form the base upon which all the cells are mounted. With cells made from opaque card or paper and illuminated from the front, the lighting must be even.

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[5] This technique is suitable only for cameras using standard 16mm double-perforated film. Single-perforated 16mm films and all 8mm films are unsatisfactory.

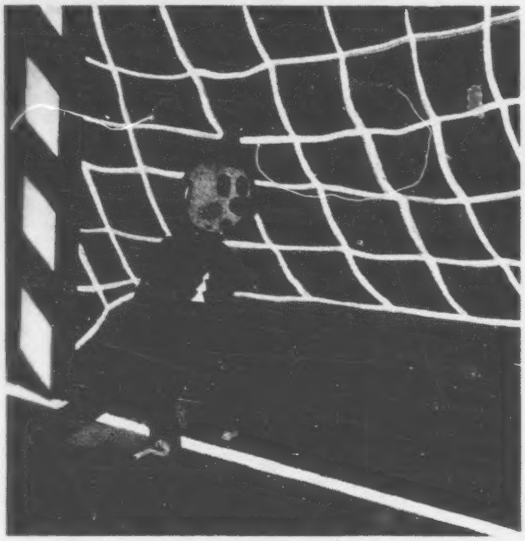


Figure 46. Cell animation

Courtesy of Soyuzmultfilm, USSR

Register punch and register pin bars provide a suitable means of punching accurate register holes in cell material and subsequently for the accurate register of this material when making up cell sandwiches.

The production of cell-animated films can be divided into three stages: *(a)* planning; *(b)* drawing; and *(c)* filming.

The first stage must not be overlooked or rushed through. Much time can be saved by carefully working out, step by step, the parts of the film that are to be emphasized. The less important scenes may then be used to link together the important scenes. Besides using the timing sheet, the whole film should be set out graphically, which entails producing drawings of each scene on suitably sized cards, say 3 X 4 in. (7.5 X 10 cm), and displaying them on a large board (storyboard). Such a board enables the visual content of the film to be assessed readily and permits small changes to be made where necessary.

During the planning stage, consideration must be given to the number of cells to be filmed in each scene. If a cell is no longer required in the filming sequence, it must be replaced with a blank cell, so that the colour and the density of the cell sandwich remains unaltered. The speed of movement of the animated figure should be studied, bearing in mind the elementary principles of movement such as acceleration and deceleration. All these factors may be recorded and accounted for on the timing sheet.

In the second stage, the details that were worked out in the planning stage are interpreted into a series of drawings on the blank cells. Apart from the artistic presentation, the only difficulty at this stage is in the precise way in which the figures must be drawn if smooth, almost lifelike movements are to be produced. Only those parts that do not move may be filmed many times over using the same cell.

The third stage is the actual filming of the cell or cell sandwich. If the first two stages have been completed properly, the camera work should not present any serious problems. The following list gives some of the more important points that should be checked before filming:

(a) Even lighting must be provided with no unwanted reflections;

(b) Accurate and consistent exposure is essential, whether the film used is colour or monochrome. The incident-light method of determining exposure should be used, with the meter held as close as possible to the cell plane;

(c) A regular check must be kept on the camera focus when filming a sandwich of cells. A piece of sheet glass (preferably plate glass) laid upon the cell sandwich will prevent the cells from buckling and causing small differences in focus;

(d) The cells or artwork should be handled with extreme care. Finger-marks, scratches, and dust spots can easily mar an otherwise good film.

Above all, the camera, stand and any movable part of the filming equipment must be supported rigidly and kept absolutely still. Periodic checks should be made on the register of the cells to ensure that no misalignment has occurred.

Puppet animation

Animated puppets afford the charm of comic and semi-comic characters at quite reasonable cost. The puppets may be made from a variety of materials—papier mâché, wax, rubber, wood, and clay are among some of those more commonly used. Other objects such as furniture, trees, fences or shrubs may be made from a variety of materials and, indeed, this subject offers great scope for the enthusiastic model maker (see figure 47). Commercially made models lend themselves very well to puppet animation. The only problem that arises is that both the puppet and its surroundings must be, as nearly as possible, to the same scale. All objects that are to appear in the scene should be secured to the base in some way. When filming, an accidental bump or jar, however slight, may cause the objects to move, which will necessitate reshooting the scene.

Animating the puppets is simply a matter of moving parts of the figure by appropriate amounts and filming it one frame at a time. Exposing two or even three frames at a time, in cases of slow action, actually improves the smoothness of the resulting movement and lessens any tendency to cause uneven motion.

The puppet animator must develop a sense of timing and study the relationship of each small

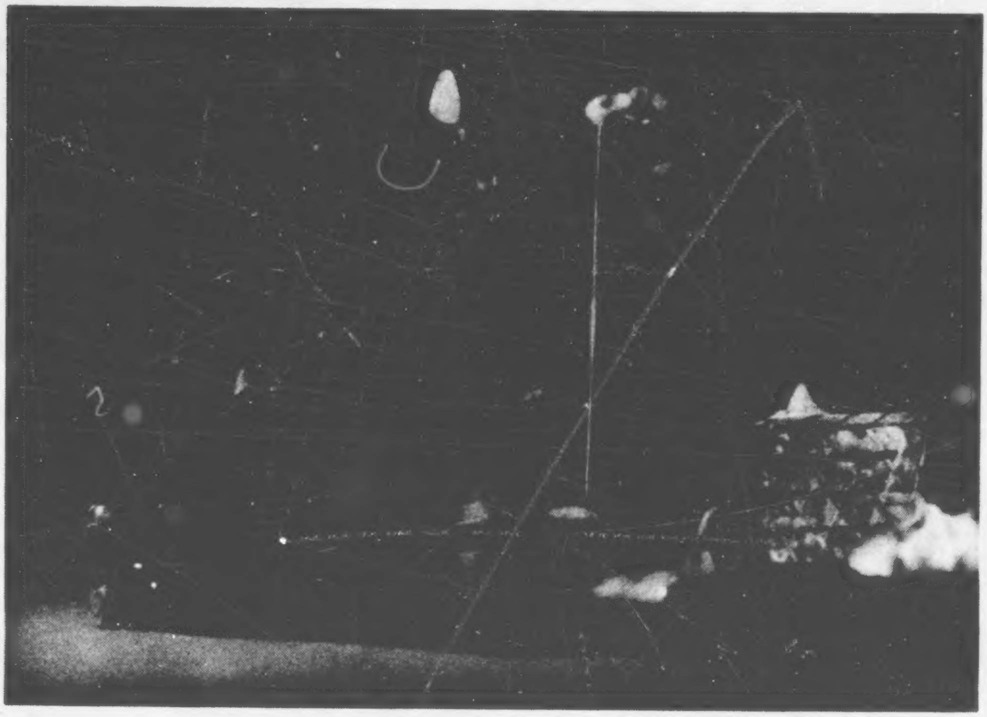


Figure 47. Three-dimensional puppet animation

Courtesy of Kawamoto, Japan

movement of the limbs of the character to the total motion being animated. Where several figures are in motion at the same time, the relationship of the movement of the figures should be studied as a whole, since each figure may require separate manipulation. At the beginning of the scene, it is best to expose several frames to establish the position of the figure before moving any of its parts. The total movement of the figure should be considered in terms of the time taken for the movement to be completed. The film speed (frames per second) may be used to determine approximately how many increments of movement will make up the total movement. The smaller the increment per single-frame exposure, the smoother and slower the final movement will be on projection.

The entire action in a scene should be visualized and tested before actual filming. Testing is accomplished easily by placing the figures in five or six key positions spaced throughout the entire action and checking the appearance of the scene in the camera viewfinder. A visual assessment of the scene with the figures in various positions will reveal any defects in composition or distracting lighting arrangements. Scenes that may appear satisfactory at the outset may develop problems later. Shadows cast from objects on the set, or actions of the figures, may tend to obscure some item in the scene as the action proceeds. It is advisable to make a dummy run of the film sequence before exposure commences to see whether the attitudes adopted by the figures in the scene produce awkward or inartistic results. It is a mistake to film too close to the subjects, since their somewhat fixed facial expressions may produce rather unpleasant effects.

Paper cut-outs

Paper cut-outs can be used to good advantage in certain types of animation (see figure 48). They retain some of the simplicity and economy of animated puppets, yet allow for some of the flexibility of expression inherent in cell animation. As with the animated method using acetate cells, they perform against a painted background. Like the puppets, their segmented bodies, arms and legs are moved fractionally between each single-frame exposure without the necessity of drawing new cells for each portion of a movement.

Animation demands patience, some craftsmanship and some understanding of film techniques. It is well worth the effort to master these skills in order to utilize the contribution this media can make to industrial film production.

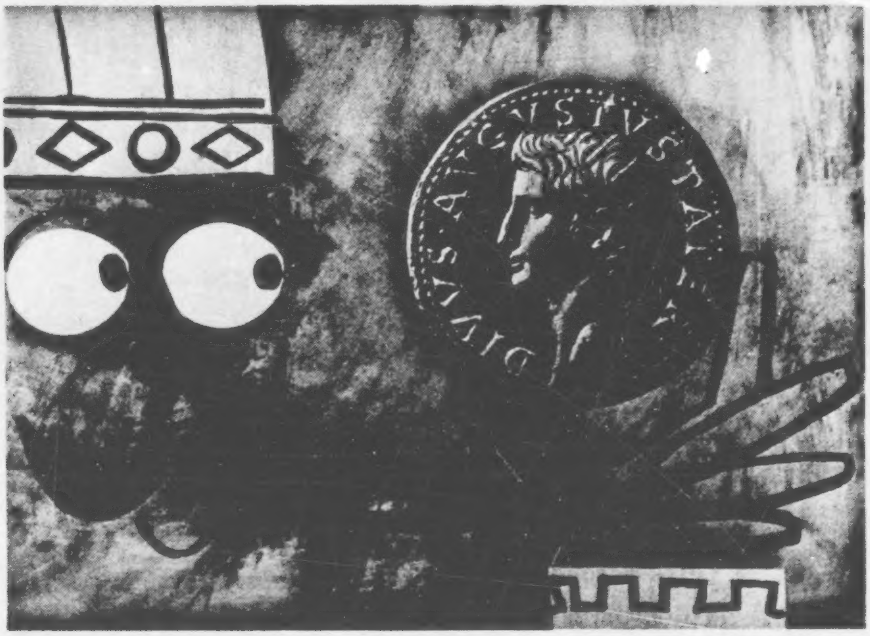


Figure 48. Paper cut-out animation
Courtesy of Teem Film AB, Sweden

Summary

For screening motion pictures from the film libraries offering professionally made industrial training films, a 16mm sound projector is indispensable.

A Super 8mm projector and camera can be a valuable tool for the industrial trainer who uses it in the simple manner recommended. The decision whether to buy a silent or sound machine will depend not only on local needs, but also on local resources for applying the magnetic stripe. The reel-to-reel cassette type of projector is to be preferred because of its simplicity in operation and safe film storage.

IX. Electronic media

The video tape recorder

The video tape recorder (VTR) is a recording machine, very much like a reel-to-reel sound tape recorder. However, there is an additional recording and playback head together with the necessary electronic circuits to permit an electronic recording of a television picture to be made. The accompanying sound is recorded on the edge of the tape, while the picture is recorded on the full width of the videotape. The VTR can be used in two ways:

(a) A TV camera can be plugged into a socket in the VTR and pictures of anything appearing in front of that camera are recorded. The sound is recorded via a microphone also plugged into the VTR. This means that a picture with synchronous sound, either of people speaking or commentary, is recorded; and immediately after the recording is made, the tape is rewound and the recording played back via a TV set;

(b) Broadcast television programmes may be recorded on a VTR when it is connected to a special TV receiver/monitor with output sockets for sound and vision, which, through connecting cables, are fed into the sound and vision inputs of the VTR. For replay, similar connecting cables and sockets carry the VTR picture and sound outputs from the VTR.

VTR machines are available for recording in black and white only, or, at a considerably higher price, can be supplied capable of recording colour TV pictures. When colour is essential, a considerably higher cost for equipment must be provided for. Not only will the VTR colour machine be more expensive, but also the TV camera for colour.

Incompatibility between VTR machines of different makes

The problems arising out of incompatibility between machines of different makes as well as between the broadcast TV systems throughout the world should be understood. A number of companies manufacture VTR machines, but the machines employ differing tape widths and standards both in black and white and colour. The width of some video tape machines, for example, is half an inch; others use a three-quarter-inch width; and the more expensive machines use a one-inch width. Generally, the wider the video tape, the higher the quality and definition of the recorded picture.

VTR machines used for broadcast purposes in TV stations employ a video tape width of two inches. For industrial training purposes, the type of machine using half-inch video tape is perfectly adequate with a black-and-white recording. If the VTR machine is used solely for recording and playback in one training location, no problems of incompatibility will arise. However, they will arise if an attempt is made to interchange tapes from one system to another.

A video tape recorded in the United States on a half-inch VTR cannot be played back on a machine of the same make in Europe. The reason is that TV standards differ between countries, much in the same manner that electric mains current varies from country to country. Without going into technical details, there are two colour TV standards in Western Europe—the PAL 625 line system and the SECAM 819 system (France). These transmissions also apply to black-and-white reception. Neither are compatible one with another, VTR machines sold in each area are designed to match the particular TV system. In the United States, a TV system different from any European standard is employed—the NTSC 525 line system.

When VTR machines are to be used for recording broadcast programmes (subject to local copyright laws), the VTR machine has to match the local TV standard. Thus, there is a serious problem of international incompatibility in the interchange of information via VTR tape recordings. Even when VTR machines are used for recording on-the-spot programme material with the use of a simple black-and-white TV camera, video tapes made can be replayed only on exactly the same make and model of VTR machine. Even then, there may be a problem in reproducing tapes recorded on one VTR machine to be replayed on another identical VTR at another location. Sometimes a trained engineer has to align the reproducing machine to replay a tape made on another machine of the same type. Therefore, as a programme carrier for information in industrial training, for international exchange, VTR is not recommended at this time. Motion-picture film is an internationally compatible carrier; and apart from its use in a projector, film can also be transferred to video tape for any local TV system, providing that there is a TV station within reach with the necessary transferring equipment.

Practical applications of VTR systems

Provided that it is used in a simple way for certain industrial training applications, a black-and-white half-inch VTR machine, together with a simple Videcon-type portable TV camera with a zoom lens, can be a useful tool. The size of TV monitor is a question of personal preference, but a TV monitor with an 18 in. screen is recommended as minimum. It is the basic equipment necessary for black-and-white VTR.

The advantage of this system is that recordings of audio-visual material may be made and then replayed immediately. This feature may be of particular value where there is no access to motion-picture film-processing facilities, yet where there is a definite need to record moving pictures for training. The low-cost VTR systems are very sensitive, so that pictures can be recorded without the need for any additional lighting in interior locations such as workshops or factories. Suggested applications are:

(a) Recording pictures of specific workshop and machine-operating techniques for training. (Most VTR machines used for this purpose are equipped so that commentary may be recorded after the picture and during a replay of the picture);

(b) Recording details of subjects that would otherwise be impossible to present to a group of trainees, e.g. recognition of faults occurring in a particular manufacturing process;

(c) Presenting a talk or lecture when the lecturer is absent, i.e. the talk is prerecorded by the lecturer in sound and vision for replay at a later time;

(d) For training personnel in delivering talks and lectures (see chapter on voice production). The VTR can be used so that the trainee speaker can record himself and afterwards replay the VTR recording and analyse his performance with a view to improving his presentation;

(e) For recording group discussions, e.g. after a training course. Although discussions can also be recorded simply on a sound-only tape recorder, having the discussion recorded visually may also be valuable, particularly where other visual aids are being referred to, such as chalkboards or flipboards. This kind of record can prove useful to the training officer in analysing a particular training course and its effectiveness. Obviously, many other applications will occur to those using VTR equipment.

Portable VTR equipment

Some manufacturers supplying half-inch black-and-white mains-operated VTR also supply matching portable VTR sets. These consist of a small battery-operated VTR that can be slung over the shoulder together with a light-weight TV camera equipped with a zoom lens. This equipment can be very useful when recordings in the field are needed, which can be replayed later at the training centre on the larger mains-operated equipment.

Suggestions for using VTR equipment

VTR equipment should be handled very carefully, since it is complex and has delicate electronic components. Ensure that any equipment to be used in tropical conditions will operate satisfactorily–many VTR machines will not do so in high temperatures and humidity.

Make no attempt to produce material comparable with professionally produced broadcast TV–rather make simple use of the camera, remembering that editing is difficult if at all possible. Make good use of close-ups, which are much more meaningful on the small TV screen.

While most VTR TV cameras can be hand-held, wherever possible make use of a tripod so as to record steady pictures–a wandering view can be distracting.

Maintain and clean the equipment according to the manufacturer's recommendations. Usually this means cleaning the tape path and guide rollers. Take great care to avoid damaging the video heads–these are extremely delicate. The instruction book that comes with the equipment will explain in detail how to avoid damaging them.

Specify the local mains current and local broadcast TV standards when ordering VTR equipment. Check that servicing facilities are available from the supplier. Make sure that the supplier carries spares. See that all connecting cables are supplied.

Finally, before deciding to install a VTR, give careful thought to the actual value it may have in the training set-up. Remember, although this kind of audio-visual equipment is novel and has the attraction of making local TV pictures, it is very much more expensive than any other aid so far described in this manual, and there is very much more to go wrong, a consideration of particular importance in remote areas where servicing in the event of faults or breakdown would be impossible.

Closed-circuit television

The equipment for closed-circuit television (CCTV) consists of a TV camera, which, in its simplest form, is fed by cable into a TV monitor (see figure 49). CCTV is used in the industrialized countries for example, in hospitals that have medical schools or in department stores to guard against theft or in factories to monitor industrial processes. All these applications make use of the TV camera to feed pictures of whatever the required information may be to TV monitors–sometimes several in different parts of a building–so that others can see what is happening in front of the camera. The value is

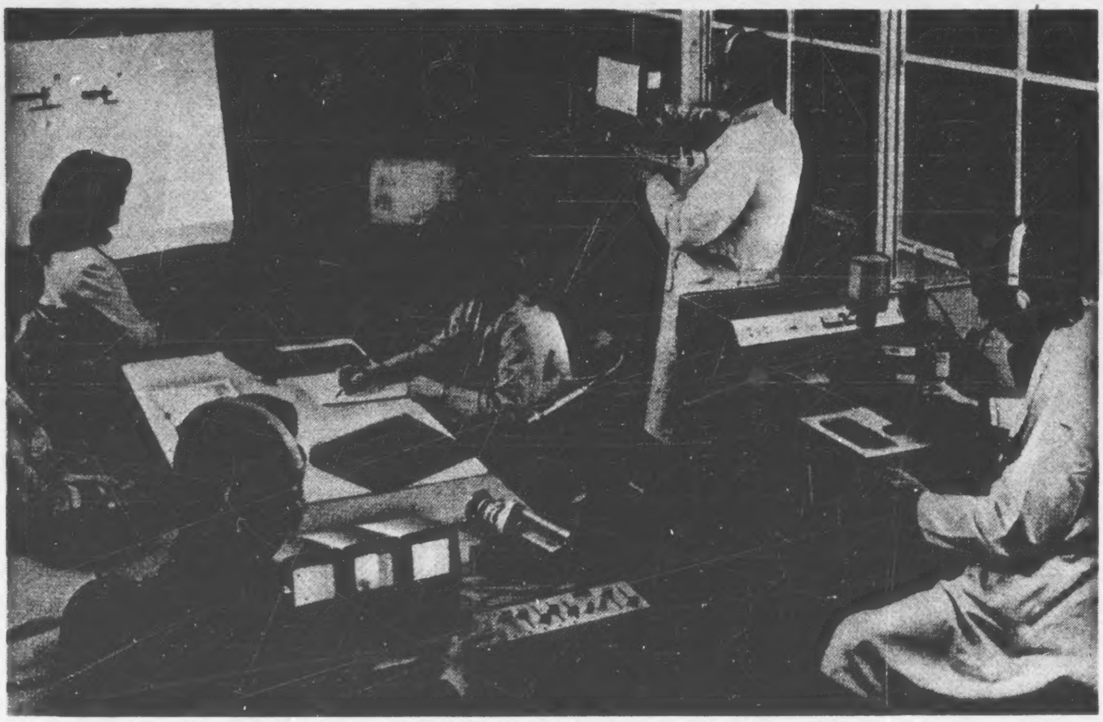


Figure 49. Closed-circuit television

Courtesy of Philips

obvious in medical training, where students may see details of surgical techniques without having to be in the operating theatre.

In industrial training, CCTV may only be of value in a very large training centre when TV pictures are to be transmitted to several lecture rooms at the same time. This technique requires more than just a TV camera and monitor. When several monitors are to be fed from a single camera source, additional electronic equipment will be needed, such as vision and sound booster amplifiers. If such complex installation is necessary, a CCTV engineering expert should be consulted for help in planning, costing and training of operating personnel.

Summary

Whether VTR or CCTV is being used as teaching tool, certain differences in technique exist as far as an instructor appearing in front of the camera is concerned. Talking to a TV camera is impersonal and quite different from addressing a group of people. Voice delivery is quite different, in that there is no need to project the voice since sound is being recorded via a microphone close to the speaker—often a small microphone worn in a sling around the neck. White clothing appears too white on a TV system and thus coloured shirts and clothing are to be preferred. Since there is a television monitor usually within the view of the speaker recording his lecture, he is always tempted to glance at his own image in the monitors during a recording. This must be avoided. Always address the camera lens.

For the small audio-visual training unit, CCTV will probably be of little value. A VTR outfit may be useful when it is difficult to make normal motion picture sequences, say, on Super 8mm film. However, all this type of equipment is much more expensive than other audio-visual equipment and very much more service will be needed. The possibility of the equipment's being out of action is also greater.

Compatibility problems must also be considered before making a final decision to use VTR and CCTV. It is an advantage if someone is available with electronic experience when these electronic systems are to be used. When VTR equipment is ordered, the supplier should be consulted as to which spares to order at the time. Adequate supplies of video tapes should be ordered then as well. VTR and CCTV equipment depends on an AC mains supply (except for the portable equipment, which is battery-operated).

Video cassette equipment

Over the past years there has been a proliferation of news reports and manufacturers' promotional publicity on what has been termed "the communications revolution". All these reports referred to the video cassette. Most of the new systems being promoted were really only in the development stage, and all of them failed to meet the dates for general availability. There has been something amounting almost to hysteria in certain sectors of the training and education fields in hailing the video cassette as the answer to all training and communications problems. This is very far from the truth.

The video cassette is, in fact, a refinement of the VTR. Instead of the video tape's being carried on spools, it is contained in a specially designed plastic cassette. The video cassette recorder (VCR) works on the same principles as the VTR except that it is only necessary to slot the video cassette into the machine, tape threading being automatic. This is much the same kind of development as was made with Super 8mm film so far as the film container and automatic threading are concerned. All VCR machines now available are for colour recording and reproduction. They will, of course, also record and reproduce black-and-white programmes.

VCR machines may be used in exactly the same way as VTR machines. Some models have built-in off-air ultra-high frequency tuner units with up to six channels that may be preset for local stations. This facility is of value mainly for educational purposes, where schools can record broadcast educational programmes for replay at times to suit their own schedule. It is also intended for a domestic market so that users may record TV programmes of their choice. These two applications are irrelevant in industrial training.

VCR machines are subject to all the compatibility problems of the VTR. From the different hardware manufacturers throughout the world, there have emerged two main standards for VCR: one from Europe employing half-inch video tape in cassettes (see figure 50), the other from the United States and Japan, using three-quarter-inch tape in a different type of cassette. One is not interchangeable with the other. The former is known as the VCR ½", the latter as the U-Matic ¾". Both types are now being marketed in all parts of the industrialized world.

Just as there is no international standard for broadcast television or VTR, there are at least two standards of VCR cassettes and systems. The U-Matic type is of higher quality than the VCR ½" and the equipment is more robust and trouble-free, but is very much more expensive. For example, the cost of a 16mm sound projector, an automatic slide projector with sound tape synchronism together with an overhead projector amounts to about half that of a VCR machine with a colour TV monitor; if a colour TV camera is added the total cost is prohibitive.

For industrial training applications, the only advantage VCR has over VTR is that tape threading is automatic. Normally, black-and-white pictures with VTR are adequate and the cost is reasonable. With VCR, the machine is designed for colour, but it is also more expensive.

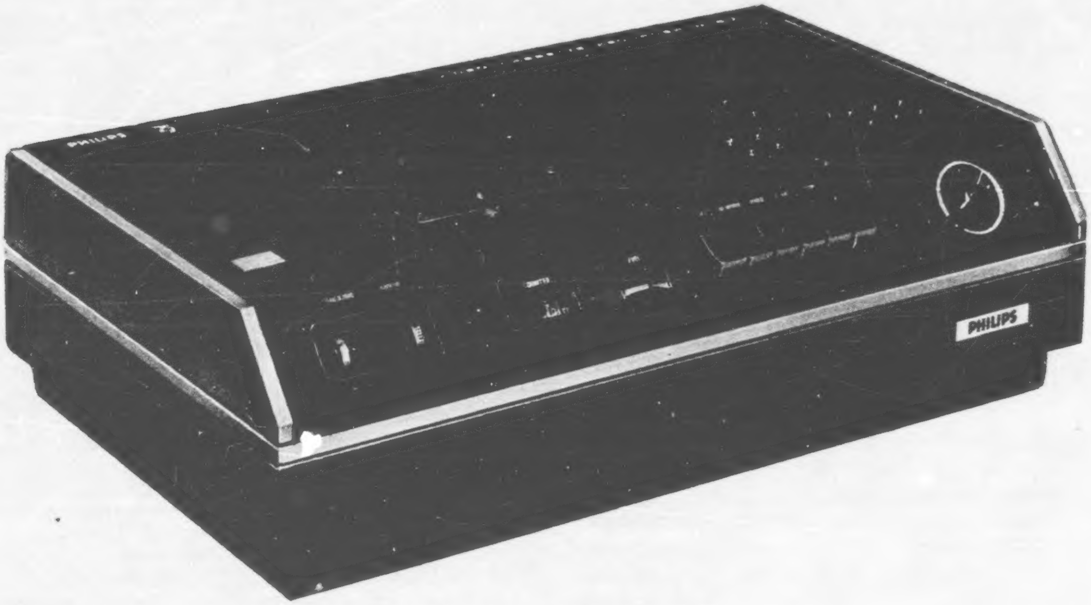


Figure 50. Video cassette recorder (VCR)

Courtesy of Philips

Although VCR machines are becoming very popular in the industrialized countries for use in schools, commerce, industry and even the home, at the present state of development and cost they would seem to be an unnecessary luxury for the small industrial training unit. Millions of dollars have been ploughed into the development and production of VCR hardware, but very little capital has been applied to the production of software programmes especially made for this new medium. The present tendency is to have existing colour movies transferred to VCR cassettes, the cost of which is high. There seems little point in showing a good training film in colour on a small TV monitor when it can be projected by a 16mm or Super 8mm projector on to a large screen.

To transfer a motion-picture film to a VCR cassette requires specialized equipment to be found only in large colour TV broadcast stations or in special transfer centres in industrialized cities. When more attention and cash are given to software production for VCR on an international basis, when perhaps new programmes for industrial training will be produced for VCR and made available in all VCR standards, the system may become more interesting for the industrial trainer. Even existing tape/slide programmes with sound could be transferred to VCR tapes. At present, the supply and sales of VCR hardware far outstrips the software supply, and it may be some years before the necessary libraries of VCR software are available so as to make such a system meaningful in industrial training. The same problems apply to the newest form of electronic audio-visual reproducer, the video disc.

The video disc

The video disc system, as its name implies, is for the reproduction of electronic TV pictures in colour from a disc, much like a record player. The programmes are printed or pressed on to flat discs like long-playing records, vision and sound being carried on the disc. The player is connected to a colour TV monitor, and thus the information is reproduced as a colour TV picture with sound. The proposed advantages of this system are that the hardware (player units) will cost less than a VCR and that the software will also cost less and can be reproduced economically in quantities just as sound record discs are pressed in large quantities (see figure 51).

So far, two systems of video disc player have been developed, one of which is electro-mechanical, rather like a record player. A pick up especially designed for video reproduction reads special grooves on the disc and thus relays the electronic information to the TV monitor, which converts it into colour pictures with sound. The second system employs laser-beam technology to "read" the disc. Both systems have been heavily promoted by their manufacturers and are commercially available. It will probably be of value mainly in the industrialized areas for education and domestic use.

Recording by the user is not possible on video disc; the system is for reproduction only. Here once more, the problems of suitable software supply have not been properly tackled. A great deal of further thought, research, development and cash will have to be put into software for the video disc. Yet there are obvious applications, such as single-concept presentations and step-by-step training programmes. For the industrial trainer, it is hard to see at this stage just how and where this system will fit in. No doubt, when the hardware and software have been fully developed and are commercially available, it will be of value to those with colour television as a relatively inexpensive means of presenting training information via the video disc. This can happen only when suitable industrial training programmes on disc are available on an international basis.

The small industrial training unit will be well-advised to keep to the more conventional and proved audio-visual aids described earlier in this manual.

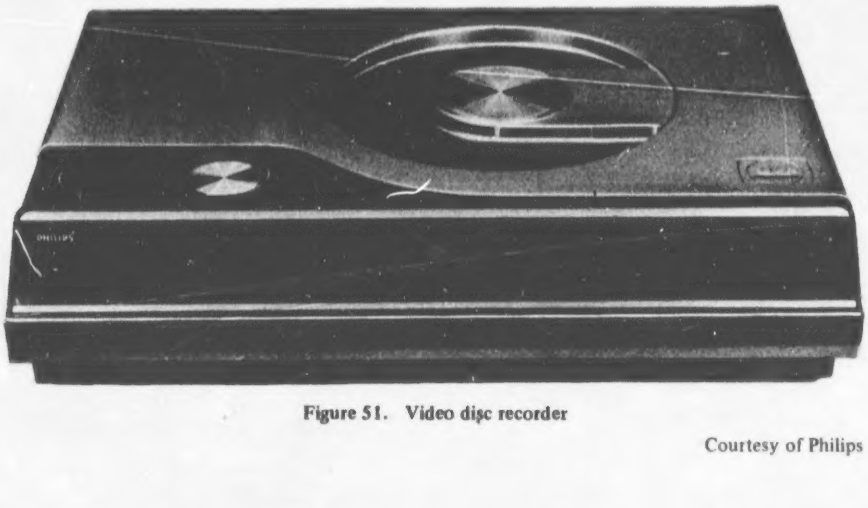


Figure 51. Video disc recorder

Courtesy of Philips

Annex I

INSTITUTIONS AND ORGANIZATIONS

International Union of Cinematographic Technical Associations (UNIATEC): national members

UNIATEC was constituted in 1957 at the Third International Congress on Film Techniques in Warsaw, its aims being defined as: (1) to develop the corporate spirit and co-operation among its members; (2) to encourage international co-operation in film techniques by the exchange of information and, more particularly, by the organizing of international colloquies and reciprocal visits of technicians from the various countries; (3) to encourage the setting-up of national associations of film technicians in countries where these do not yet exist; (4) to encourage studies for the advancement of film techniques, and to support any efforts undertaken in the direction of standardization.

The Union is open to all associations (or specialized sections of associations) of film technicians whose aims are confined to work and discussion of a technical nature.

Secretariat: 92, Champs-Elysées, 75008 Paris, France.

The information given below was supplied by UNIATEC.

Belgium

Commission supérieure technique belge–Cinémathèque de Belgique (Siège social)
23, rue Ravenstein
Bruxelles 1
(address correspondence to):
Laboratoire Dassonville
135, rue Barthelot
Bruxelles 10

Bulgaria

Institute for Scientific Research in Cinematography and Radio
2, rue Budapeste
Sofia

Canada

National Film Board
P.O. Box 6100
Montreal 3
Quebec

Czechoslovakia

Ústřední ředitelství Ceského filmu
Jindrišská 34
Praha 2

Výzkumný ústav zvukové, obrazové a reprodukční techniky (VUZORT)
Plzeňská 66
Praha 5 (Smichov)

Interkamera–Centre for International Co-operation in the Field of Audio-Visual Engineering and Art
Konvitská 5
Praha 1

Democratic People's Republic of Korea

Union of Korean Film-Makers
Pyong-Yang

Denmark

Den Danske Sektion Nordisk Film og Gjernzynsunion
Statens Filmcentral Vestergade 27
Copenhagen K

France

Commission supérieure technique (C.S.T.)
92, Champs-Elysées
Paris 8

German Democratic Republic

Wissenschaftlich-technischer Beirat des Filmwesens der DDR
DEFA Zentralstelle für Filmtechnik
Gross-Barliner Demm 61
1197 Berlin Johannisthal

Hungary

Optikai Akustikai es Filmtechnikai Egyesulet
VI Ankerköz 1
Budapest

Italy

Associazione tecnica Italiana per la cinematografia (ATIC)
Viale Regina Margherita 286
Rome

Mexico

Sindicato de Trabajadores Técnicos y Manuales de Estudios y Laboratorios de la Producción Cinematográfica
Versalls Núm. 27
México 6–D.F.

Poland

Filmowy Osrodek Dosciadczalno Uslugowy (F.O.D.U.)
Ul. Dominikanska 9
Warsaw 25

Romania

Associata Cineastilor din Republica Populara Romina (A.C.I.N.)
Strs. Gheorghe Gheorgiu Daj 63
Bucharest 1

Sweden

Svenska Filminstitutet
Borgvägen 1–Box 27126
10252 Stockholm

Tunisia

Association des cinéastes tunisiens
c/o Maison de la Culture
16, rue Ibn Khaldoun
Tunis

Union of Soviet Socialist Republics

Union of Soviet Filmmakers
"Science and Technique" Section
13 Vasilievskaia Street
Moscow

Nautchno Isledoviatelsky Kino Foto Institut (NIKFI)
Leningradski Prospect 47
Moscow

United Kingdom of Great Britain and Northern Ireland

Cinematograph Exhibitors' Association of Great Britain and Northern Ireland
22-25 Dean Street
London W.1

British Kinematograph, Sound and Television Society (BKSTS)
110-112 Victoria House
Varnon Place
London W.C.1

United States of America

Society of Motion Picture and Television Engineers (SMPTE)
9 East 41st Street
New York, N.Y., 10017

Yugoslavia

Jugoslavija Film
Knez Mihailova 19
Belgrade

National Branches of the International Council for Educational Media (ICEM)

The Council was founded in 1950 under the name of the International Council for Educational Films in order to cope with the wide range of educational media for which its national organizations were responsible. The name was changed in 1966 to the International Council for the Advancement of Audio-visual Media in Education, and in 1970 to its present title. Full membership is open to one person from each country competent to represent the national organization for production, distribution and use and/or information on modern media for education. The objectives of ICEM include: to promote world-wide contacts; to provide an international channel for an exchange of views and experience in the field of educational technology; and to promote a better integration and use of all modern media in education.

Secretariat: 29, rue d'Ulm, 75–Paris 5, France.

Argentina

Departamento de Tecnología Educativa
Ministerio de Educación
Lavalle 2634–2° Piso
Buenos Aires

Australia

Education Liaison Officer,
Canberra House,
Maltravers Street,
Strand,
London W.C.2R 3EH,
England

Austria

Bundesstaatliche Hauptstelle für Lichtbild und Bildungsfilm (SHB)
Sensengasse 3
A-1090 Vienna

Belgium

Service cinématographique
Ministère de l'éducation et de la culture française
7, quai du Commerce
1000 Bruxelles

Service cinématographique
Ministère de l'éducation et de la culture flamande
7, quai du Commerce
1000 Bruxelles

Canada

National Film Board of Canada
1 Grosvenor Square
London W.1X OAB
England

Benin

Service des moyens audio-visuels
Ministère de l'éducation nationale
Porto Novo

Denmark

Statens Filmcentral
Vestergade 27
1456 Copenhagen K

Finland

Valtion Opetuselokuvatoimikunta
Bulevardi 17 A 14
00120 Helsinki 12

France

Office français des techniques modernes d'éducation
(OFRATEME)
29, rue d'Ulm
75–Paris 5

German Democratic Republic

Deutsches pädogogisches Zentralinstitut
Krausenstrasse 8
108 Berlin

Germany, Federal Republic of

Institut für Film und Bild in Wissenschaft (FWU)
Bavaria–Film-Platz 3
8022 Grünwald, b. Munich

Ghana

Ghana National Audiovisual Centre
Ministry of Information
P.O. Box 745
Accra

Guatemala

Audiovisual Centre of the University of San Carlos
Cuidad Universitaria
Zona 12
Guatemala

Hungary

Committee for Audio-Visual Media
Martinelli Ter 8
Budapest V

Japan

Japan Audio-Visual Educational Association
(JAVEA)
26 Nishikubo Sakuragawacho, Shiba
Minato-ku
Tokyo

Kuwait

Audio-visual Aids Department
Ministry of Education
Kuwait

Luxembourg

Centre audio-visuel
Office du Film scolaire
Walferdange

Madagascar

Ministère des Affaires culturelles
Direction générale des services académiques
Direction de l'enseignement du 1er degré
B.P. 267
Tananarive

Mexico

Instituto Latinoamericano de la Communicación
Educativa (ILCE)
UNESCO/México
Apartado postal 18862
México (18) D.F.

Netherlands

Nederlands Instituut voor audiovisuale media
(NIAM)
31/33 Sweelinckplein
Postbus 6426
The Hague 2078

Norway

Statens Filmcentral
Schwensensgate 6
Oslo 1

Poland

Instytut pedagogiki
Ul. Gorozewska 8
Warsaw

Portugal

Institute for the Audio-visual Media in Education
Rue Florbela Espanca
Lisbon 5

Sweden

Utbildningsförlaget
Fack S 104 22
Stockholm

Switzerland

Centrale du film scolaire
Erlachstrasse 21
CH 3000 Berne 9

Tunisia

Secrétaire général de l'Institut des sciences de
l'éducation
17, rue Fénelon
Tunis

Turkey

Education Aids and Technical Co-operation
Ministry of Education
Ankara

United Kingdom of Great Britain and Northern Ireland

England
Educational Foundation for Visual Aids (EFVA)
33 Queen Anne Street
London W.1M OAL

Scotland
Scottish Film Council
16/17 Woodside Terrace
Glasgow C3

United States of America

Division of Educational Technology
National Education Association
1201 Sixteenth Street, N.W.
Washington D.C. 20036

Yugoslavia

Educational and Cultural Film Centre
Marsala Tita 2
Belgrade

Scientific Film Associations

National Branches of the International Scientific Film Association (ISFA)

ISFA is a non-profit-making and non-governmental organization, that groups the national associations representative of the scientific film movement of various countries. It was constituted in 1947 at a meeting in Paris attended by representatives of many countries and of UNESCO. The Association was created "in the belief", as is stated in the preamble to its constitution, "that international co-operation in the field of science must contribute increasingly to the maintenance of peace between nations and to the well-being of mankind, and that in such co-operation the cinema has a major rôle to fill. The members of the Association are persuaded that all those methods" (research, teaching and the dissemination of scientific knowledge) "by which cinematography can assist in the increase of human welfare through the application and development of science should be more earnestly and more widely pursued".

Since the, ISFA has stimulated the forming of national scientific film associations in a number of countries and developed practical procedures for furthering its main functions, which are: "The freest, widest and most efficient exchange of: information about production, the use and the effect of all types of scientific films; films themselves and cinematic material; the personal experience, skills and ideas of workers in scientific cinematography".

Each year, it organizes in a different country an international congress and festival where selected films are presented and specialized papers are read.

In addition, the specialized sections (research, higher education, popularization of science) hold meetings in the course of the year.

Headquarters: 38, avenue des Ternes, 75–Paris 17, France.

The information given below was supplied by ISFA.

Argentina

Investigaciones Cinematográficas de la Universidad de Buenos Aires
Perú 222
Buenos Aires

Australia

Commonwealth Scientific and Industrial Research Organization
314 Albert Street–P.O. Box 89
East Melbourne
Victoria 3002

Austria

Bundesstaatliche Hauptstelle für Lichtbild und Bildungsfilm
Abteilung wissenschaftlicher Film
5 Schönbrunnerstrasse 56
A-1060 Vienna

Belgium

Institut national de cinématographie scientifique
31, rue Vautier
1040–Brussels

Brazil

Institute Nacional de Cinema
Praça da República 141–A–2e andar
Rio de Janeiro

Bulgaria

Popular Science Films Studio
9 Boulevard Biruzov
Sofia

Canada

Canadian Science Film Association
Canadian Education Association
252 Bloor Street West
Toronto

Czechoslovakia

Czechoslovak Scientific Film Association, at Czechoslovak Academy of Sciences
Zahradnikova 28
Brno

Democratic Peoples Republic of Korea

Korean Scientific Film Association,
Pyong Yang

France

Institut de cinématographie scientifique
38, avenue des Ternes
75–Paris 17

German Democratic Republic

Nationale Vereinigung für den wissenschaftlichen Film in der DDR
Alt Newawes 116/118
1502–Potsdam Babelsberg

Germany, Federal Republic of

Institut für den wissenschaftlichen Film
Nonnenstieg 72
34–Göttingen

Hungary

National Hungarian Committee
Magyar Film es Müvészek Szëvetsége
Gorkij Faser 38
Budapest VI

Israel

Israel Scientific Film Organization
P.O.B. 7181
Jerusalem

Italy

Associazione Italiana de Cinematografia Scientifica
via Alfonso Borelli 50
Rome

Japan

The Japan Science Film Institution
2-1 Surugadai Kanda
Chiyoda-ku
Tokyo

Netherlands

Netherlands Scientific Film Association
Hengevoldstraat 29
Utrecht

Philippines

The Scientific Film Association of the Philippines
c/o National Science Development Board
P.O. Box 3596
Manila

Poland

Polish Scientific Film Association
Al. Ujazdowskie 45
Warsaw

Romania

Studio Cinematografic Alexandru Sahia
B-dul Aviatoriler 106
Bucharest

Spain

Associación española de Cine científico
Patronato "Juan de la Cierva"
Serrano 150
Madrid 2

Union of Soviet Socialist Republics

Association of Filmmakers of the USSR
Vasilieveskaya 13
Moscow

United Kingdom of Great Britain and Northern Ireland

British Film and Scientific Film Association
15 New Bridge Street
London E.C.4

Scientific Film Association
48 Puston Paths
Stevenage
Hertfordshire

United States of America

American Science Film Association
7720 Wisconsin Avenue
Bethesda
Maryland 20014

Uruguay

Associación Uruguaya de Cine científico
Juan L. Cuestas 1525
Montevideo

Corresponding members

Cuba

Ministerio de Educación
Dirección Nacional de Extensión Cultural
36–4708, Mariano (13)
Havana

Mexico

Mr. Galdino Gómez Gómez
Director de la Cinemateca Mexicana
Instituto Nacional de Antropología e Historia
Departemento de Promoción y Difusión
Córdoba 45
México 7 D.F.

Switzerland

Communauté d'action pour le développement de l'information audio-visuelle
10, avenue d'Epenex
1024–Ecubiens (Vaud)

Venezuela

Director, The Venezuelan Institute of Scientific Research
Ministry of Health and Social Assistance
Apartado 1827
Caracas

Annex II

CONVERSION OF PROJECTION RUNNING TIME TO FOOTAGE

PROJECTION RUNNING TIME TO FOOTAGE

Time in minutes	35mm @ 24 fps		16mm @ 24 fps		SUPER 8mm SOUND @ 24 fps	
	Feet	Metres	Feet	Metres	Feet	Metres
1	90	27·43	36	10·97	20	6·10
2	180	54·86	72	21·95	40	12·19
3	270	82·30	108	32·92	60	18·29
4	360	109·73	144	43·89	80	24·38
5	450	137·16	180	54·86	100	30·48
6	540	164·59	216	65·84	120	36·57
7	630	192·02	252	76·81	140	42·67
8	720	219·46	288	87·78	160	48·76
9	810	246·89	324	98·75	180	54·86
10	900	274·32	360	109·73	200	60·96
15	1350	411·48	540	164·59	300	91·43
20	1800	548·63	720	219·45	400	121·91
25	2250	685·79	900	274·31	500	152·39
30	2700	822·94	1080	329·18	600	182·87
35	3150	960·10	1260	384·04	700	213·35
40	3600	1097·26	1440	438·90	800	243·84
45	4050	1234·42	1620	493·76	900	274·30
50	4500	1371·57	1800	548·63	1000	304·78
55	4950	1508·73	1980	603·49	1100	335·26
60	5400	1645·89	2160	658·36	1200	365·74
120	10800	3291·78	4320	1316·71	2400	731·51
180	16200	4937·67	6480	1975·07	3601	1097·57

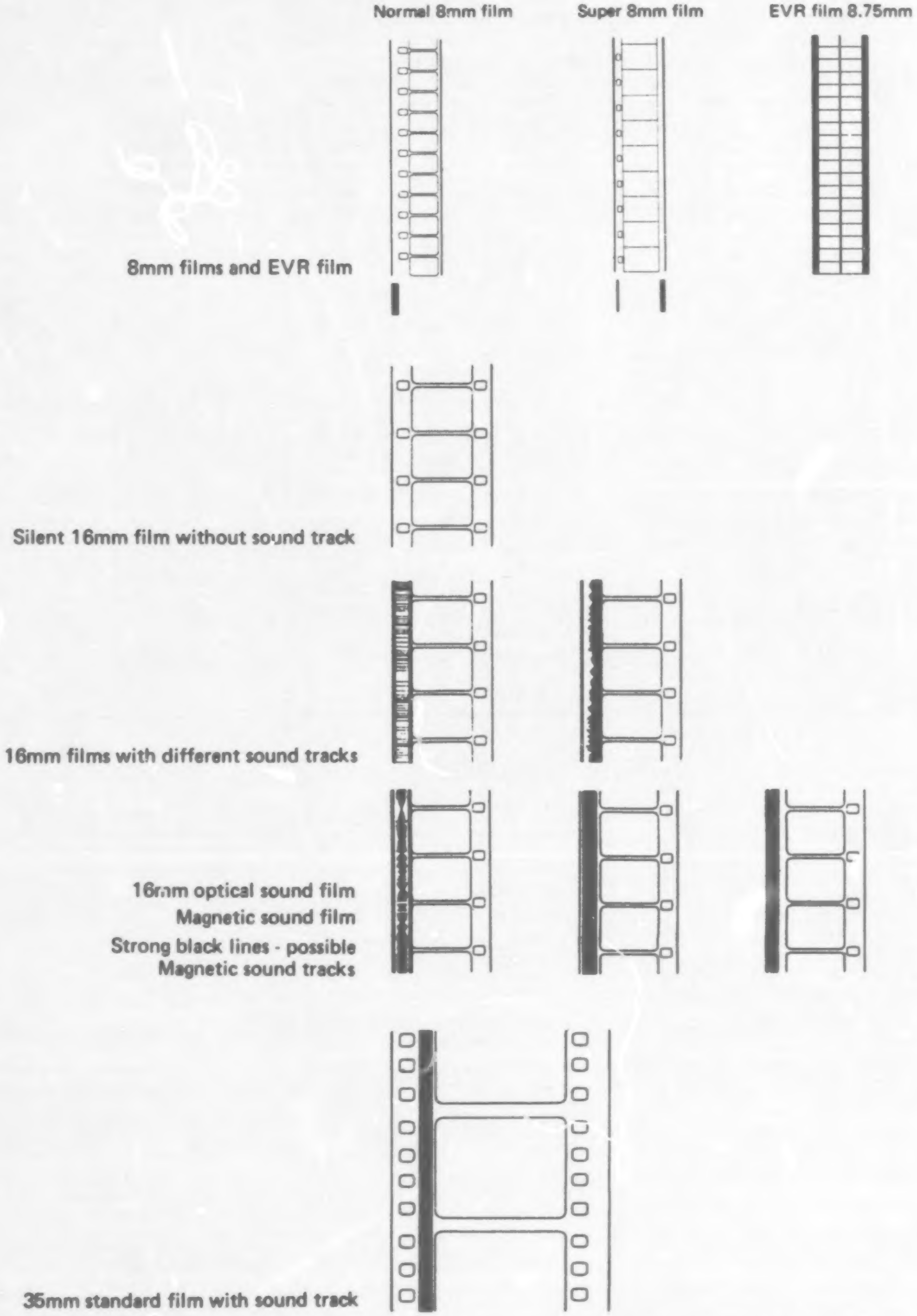
CONVERSION TABLE

Feet	Metres	Metres	Feet
1	.3048	1	3.2808
2	.6096	2	6.5617
3	.9144	3	9.8425
4	1.2192	4	13.1234
5	1.5240	5	16.4042
6	1.8288	6	19.6850
7	2.1336	7	22.9659
8	2.4384	8	26.2467
9	2.7432	9	29.5276
10	3.048	10	32.8084
20	6.0960	20	65.6168
30	9.1440	30	98.4252
40	12.1920	40	131.2336
50	15.2400	50	164.0420
60	18.2880	60	196.8504
70	21.3360	70	229.6588
80	24.3840	80	262.4672
90	27.4320	90	295.2756
100	30.4800	100	328.0840
200	60.9600		
300	91.4400		
400	121.9200		

Courtesy of Universal Film Laboratory, London

Annex III

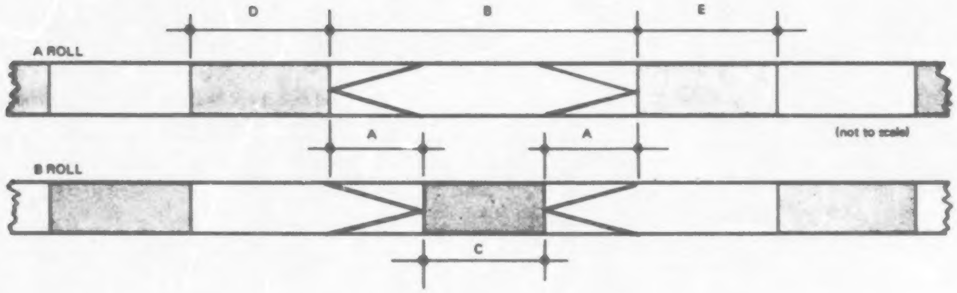
COMPARATIVE FILM SIZES WITH SOUND TRACKS


Normal 8mm film
Super 8mm film
EVR film 8.75mm
8mm films and EVR film
Silent 16mm film without sound track
16mm films with different sound tracks
16mm optical sound film
Magnetic sound film
Strong black lines - possible
Magnetic sound tracks
35mm standard film with sound track

Courtesy of Universal Film Laboratory, London

Annex IV

FADES AND DISSOLVES



A. Length of overlap for mix required—lengths available 16, 24, 32, 48, 64 and 96 frames.

B. Minimum scene length when a mix at either end is required—The sum total of frames of the mixes required, plus 4 frames or 10% of the length of the mix at the head of the scene.

Example (a) 16 frame mix at head and a 96 frame mix at tail.

16 + 96 – 112 + 4 – 116

(b) 48 frame mix at head and a 48 frame mix at tail.

48 + 48 – 96 + 10% of 48 (to nearest frame i.e. 5) – 101

C. Minimum number of frames between a fade-out and fade-in on the same roll— 4 frames or 10% of the length of the fade-out.

D. Minimum number of frames required after a straight cut, before a mix or fade-in—20 frames.

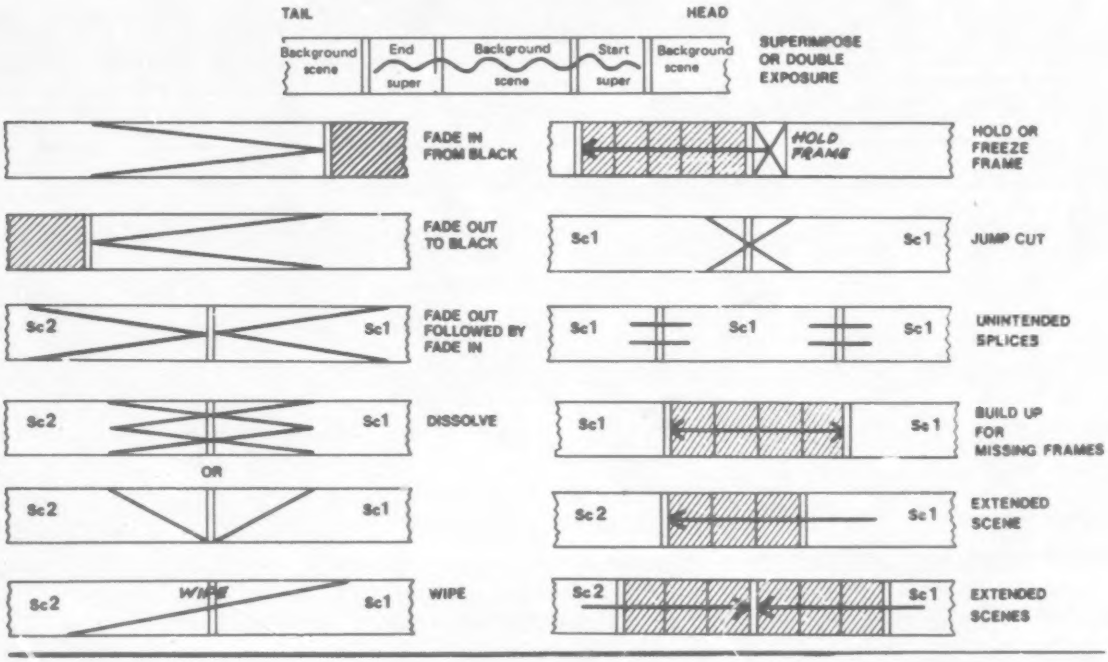
E. Minimum number of frames required before a straight cut, after a mix or fade-out—20 frames.

N.B. Fades or mixes of any of the available lengths may be interspersed throughout a printing run.

Courtesy of Universal Film Laboratory, London

Annex V

METHODS OF MARKING CUTTING COPIES FOR FADES AND DISSOLVES ETC.


TAIL
HEAD
Background scene
End super
Background scene
Start super
Background scene
SUPERIMPOSE OR DOUBLE EXPOSURE
FADE IN FROM BLACK
HOLD FRAME
HOLD OR FREEZE FRAME
FADE OUT TO BLACK
Sc1
Sc1
JUMP CUT
Sc2
Sc1
FADE OUT FOLLOWED BY FADE IN
Sc1
Sc1
Sc1
UNINTENDED SPLICES
Sc2
Sc1
DISSOLVE
Sc1
Sc1
BUILD UP FOR MISSING FRAMES
OR
Sc2
Sc1
Sc2
Sc1
EXTENDED SCENE
Sc2
WIPE
Sc1
WIPE
Sc2
Sc1
EXTENDED SCENES

Courtesy of Universal Film Laboratory, London